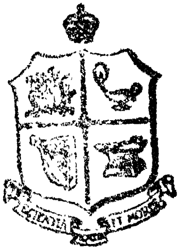

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EDUCATION FOR TRADES AND INDUSTRIES

EDUCATION FOR TRADES AND INDUSTRIES

A HISTORICAL SURVEY

BY

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PREFACE

Of recent years there has been apparent a keener interest in the historical side of industry and the efforts which were made in early days to provide technical education for those engaged in various trades. It seemed opportune to bring together in one volume the story of the rise and progress of technical education for a number of trades and industries. The present work is intended as a supplement to the author's book on Technical Education in which an account is given of the early problems which were encountered and the way in which provision was made for carrying on the work. It does not pretend to cover the ground exhaustively but should be sufficient to give a clear idea of movements not generally known and requiring reference to many papers not easy to find and almost unknown to the present generation of workers in this field.

It is believed that this is the first attempt to present in collective form this information, and it has been written to assist the future of technical education by affording an opportunity of reference to early history in a concise and convenient form. It is hoped that those working in the trades and industries dealt with, and those engaged in technical education or interested in education in general, will find in this little book much that will prove of interest.

C. T. MILLIS.

July, 1932.

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EDUCATION FOR TRADES AND INDUSTRIES

I

INTRODUCTION

In the Author's book on *Technical Education: its Development and Aims*,[1] the history and development of the earlier movements for providing Technical Institutes and facilities for bringing education into contact with industry were described and the general principles upon which sound technical education should be based considered. Since it was written there has been a great change of opinion, particularly on the side of industry, about vocational and technical education, and much has been said about the closer co-operation of education with industry.

There appears to be a feeling in the minds of many persons that education ought to have done more to assist industry. Whatever may be the defects, if any, in our educational system this particular failure has certainly not been the fault of technical education, for one of its main objects has always been the attempt to get into touch with industry. What has happened is that industry itself is now waking up to the value of technical education and is therefore taking a livelier interest in it.

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[1] The letters T.E. are used to refer to this book.

With a few notable exceptions, such as Sir W. Mather, G. N. Hooper, J. Hunter Donaldson, Sir Bernhard Samuelson, the Master Printers' Association, the Master Bakers' Association, and others, employers in the past have not been too helpful or appreciative of what was being done or could be done by technical education to assist industry. The demand for education has rather come from the workers themselves.

In the greater desire for a close association of education with industry there is to some extent a parallel with what occurred in several trades and industries in 1879 which brought the technical education movement into prominence, namely:

1. The desire of employers and workers to be able to compete with other countries through improved methods of production, and the feeling that technical education might help them to do so. At the present time this feeling is intensified by the large amount of unemployment.
2. The desire to keep up the standard of skill in craftsmanship by increasing through educational facilities the opportunities of training to make up for the decay of the apprenticeship system caused mainly by subdivision of labour and mass production.

In order that a clearer knowledge may be gained or what has been achieved by the technical institutes in association with various trade organizations, it is necessary to make a short survey of some of the movements in technical education. The successive steps that have led to the present position of technical education are of special interest at the present time and should be better known. The accounts given of the early history of several trade movements in education tracing the progress that has been made, show the steady growth and extent to which education has been brought into contact with industry especially during the past thirty-five years.

The valuable work which has been done through technical education is not sufficiently recognized, even by those engaged in some industries which have profited. Technical education has also exerted a beneficial influence on primary and secondary education. This was referred to in Chapter VII, T.E., and it is not written as a defence of technical education but as a statement of fact. Notwithstanding an amount of apathy in the past progress has been great. Evidence of this is afforded by the founding of Trade Professional Institutions and of the Associations of Technical Institutions, of Principals and of Teachers in Technical Institutions whose conferences have done much good work in focusing public opinion on educational matters.

The developments that have been made show the interest taken in some industries by the employers and in others by employees themselves, all with a belief and inspiration tending to the uplifting and raising the status of those engaged in the trades with a view to increasing the importance of industrial education in the minds of the public and the dignity of manual labour. The names of the early workers—who deserve great credit for their enthusiastic and devoted service as pioneers—are given.

It may also be remarked here that much of the information is drawn from the personal experience and knowledge of the Author, who, as Secretary of the Artisans' Institute, Superintendent of the Trade Class Department of Finsbury Technical College, Principal of the Borough Polytechnic Institute for thirty years, one of the Founders of, Member and Past Chairman of the Council of the Association of Technical Institutions, a

Member of various advisory committees and a Member of the Examinations Board of the City Guild Institute (nominated by the President of the Board of Education), has been identified with many of the movements described.

The following accounts of the beginnings and progress of education for a number of trades and industries are additional, especially in detail, to those given in Chapters V and VI, T.E. They show how these early efforts were stimulated, fostered and supported by the City Companies individually; e.g. the Goldsmiths', the Clothworkers', the Drapers', the Leathersellers', the Carpenters', the Plumbers' and the Bakers' Companies; by the City Companies collectively associated as the City and Guilds of London Institute and by Associations of Employers and Trade Organizations.

It should also be noted that generally where much success has been attained it has been due to the observance of the cardinal principles of technical education emphasized by the early workers (stated in Chapter IX, T.E.) and such principles should be kept in the forefront in this country. These records may help to prevent possible mistakes in the further development of technical education through making it too academic or scientific in character and neglecting the importance of craftsmanship.

In 1927 a Report was published of an "unofficial inquiry" into the Relationship of Technical Education to other forms of Education and to Industry and Commerce. This Report was issued by a Committee which began work under the Chairmanship of the late Rt. Hon. Lord Emmott, G.C.M.G.; and on it were representatives of the Professional Institutions of Mechanical, Electrical, Chemical, Gas, Mining and other branches of

Engineering Science, the several Associations connected with various branches of Technical Education, and Societies representing Art, Secondary and Primary education.

The opening paragraphs of the Report explain the reasons which led to the Inquiry, and the second paragraph is worth quoting in full:

> " Are the objects of its original promoters still inspiring the Authorities and Institutions which now control the Technical Education movement? Do these original objects require modification? Is progress not approaching a standstill for lack of the enthusiasm which pervaded the service in its earlier days? Should there not be a new adjustment in the relation of Technical Education to Industry and Commerce on the one hand, and to General Education on the other? Have we in fact a national policy, or are we drifting in the wake of general educational progress? "

The Report is useful, suggestive and gives much information on the subject with which it deals. Questionnaires were issued to industrialists, local education authorities, principals of technical institutes and of schools of art, and the report includes summaries of their replies. Particularly interesting is the Report or Summary of replies collated by the Federation of British Industries. The Federation draws attention to two main points arising out of the Inquiry, one of which is quoted here in full.

> " That if the utmost value is to be derived from the money spent on technical education it is essential that a much more intimate liaison be established between those responsible for the direction of the industrial life of the country and those responsible for the technical education of those who are, or ultimately will be, workers in the industrial life."

The Federation goes on to give the replies it received to several questions and a brief reference is made to two or three of the most important. The replies to the question, *Do you regard Technical Education as essential to the conduct and development of your industry?* show an overwhelming body of agreement not only on the desirability, but also on the absolute necessity of an adequate technical education.

The question: *What special, i.e. technical, education is required for the following representative functions · (a) The Artisan; (b) The Foreman; (c) The Management; and (d) The Directorate?* brought some suggestive replies, one of which was as follows: "It is evident from a considerable number that the opportunity to progress from artisan to management is still regarded as an essential of works administration."

The question about the selection and training of teachers for technical colleges is dealt with both by the Federation and by the representatives from Technical Institutions. It is generally admitted that such teachers must have trade experience.

Many other important questions are dealt with in the Report, some of which are of an administrative and educational character of great interest to those engaged in the management of technical institutions.

It is believed that the accounts which follow of what has been done in several industries will answer and give information on some of the questions raised in the Emmott Report, and may be of general interest to employers.

Much attention is being paid to grouped courses of instruction as guides for the workers in various trades and industries. The importance of such courses was recognized at Finsbury Technical College as early as 1882 (and in a modified form at the Artisans' Institute in 1879), and courses of instruction were planned for the engineering, building and other trades. As these are of historical interest, some of these courses and brief syllabuses are given at the end of the chapters which deal with the trades for which they were arranged. They are useful for comparison with present courses, which are now provided under better conditions than many of the early workers had in their Institutes.

The Education Act of 1870 has borne fruit, and the old type of "Night School" is no longer necessary. In their stead we have the evening Junior Technical Institutes, providing preliminary courses of instruction for pupils from 14 to 16 years of age who have left the primary schools and have not attended day continuation schools or Junior Technical schools.

In comparing the examination results given for some trades and industries, it is necessary to remind the reader that, by an arrangement between the Board of Education and the City and Guilds of London Institute, in 1920, no examinations, except in one or two subjects, are held below the Final grade in England and Wales by the Institute. This arrangement is under consideration and it is hoped it may be altered.

II

BUILDING TRADES

(GENERAL)

Before Science and Special Trade classes for workmen in the building trades were started, the men had the advantage of books and the knowledge of Architects who were acquainted with their requirements. The Science and Art Department classes in Practical Plane and Solid Geometry and Building Construction from about 1859 (to which reference has been made in Chapter III, T.E.) may be said to be the foundation upon which technical education for the building trades was based. These classes were largely attended by bricklayers, masons and carpenters. The older men, who had generally been apprenticed in their youth, found them very useful and many were able by studying these subjects to become foremen, general foremen and clerks of works—some, as we shall see, became technical teachers for their trade. But in 1873 and 1874, owing to the loss of opportunities of sound training in the workshops, came the demand for separate classes designed to meet the special needs of the men engaged in each of the branches of the building trade—bricklaying, masonry, carpentry, plumbing and house painting and decorating. Some of the leading men engaged in the last-named trade attended art classes, but the less-skilled men found they needed instruction definitely connected with their job.

In a letter to *The Times* of December 29th, 1882, Colonel Stanley Bird, President of the National Association of Master Builders of Great Britain, said that the builders of England were fully alive to the necessity of properly and systematically training the young workmen and had discussed the matter at their meetings. He had, in 1881, read a paper on the subject at their Annual Meeting, and further said much had been and much more might be done by the City Companies which represented the manual trades such as the carpenters, masons, bricklayers, plumbers and plasterers.

The building trades of London suffered from lack of apprentices and the workmen were largely recruited from the country, being young men who had learnt their trade in small shops and come in as "Improvers." This fact was brought out in a valuable Report on the Building Trades in 1899, drawn up by a special Sub-Committee of the London County Council. This report is useful for reference. The Chairman of the Committee was the late Richard Roberts, a Master Builder, and Governor of the Northern Polytechnic, Holloway, which owes much to his interest in technical education and support of the Building Trades Department of that institution.

The first technical classes for members of the Building trades were opened at the Artisans' Institute, St. Martin's Lane, W.C., in 1874 and were later transferred to the City Science Classes then being held in the Cowper Street Schools pending the completion of the Finsbury Technical College which was opened in 1883. Building trade classes were amongst the first classes opened at the Regent Street Polytechnic in 1882 under A. Harland, A.R.I.B.A., and J. Channon, both of whom were on the staff of the Finsbury Technical College at that time. In connection with the suggestion of Colonel S. Bird that the City Companies might do more for technical education, it may be stated here that the Trades Training Schools, which owe their origin and maintenance to the Carpenters' Company, were established in 1893, in Great Titchfield Street, London. Practical classes for Carpenters, Bricklayers, Plumbers, Plasterers, Painters and other workers are held there and are supported by the City Companies connected with those trades.

Building trade classes were opened in the Manchester Technical School and University College, Nottingham, in 1885, and were followed by classes in technical institutes and colleges throughout the country.

The examinations in the principal building trade subjects which were held by the City and Guilds of London Institute in 1881, 1884 and 1886, were undoubtedly a great incentive to the opening of such classes.

The earlier classes referred to were evening classes, and there were no day classes for the building trades like those for Engineering at the Finsbury and other Colleges and Institutes in the country. The Author called attention to this in his evidence in 1897 before the London County Council Sub-Committee on the Building Trade, in which he said:

> " At present there is no day school for the building trades. The engineering trades are much better off in this respect. Many years ago a day department for instruction in the building trades was started at the Finsbury Technical College (this was in 1883) but failed owing to the fact that it was too much on the lines of an engineering course. A similar case was that of the department of the late Professor Roger Smith

at University College. At the request of Professor Silvanus P. Thompson (Principal of Finsbury College) I drew up a scheme for a day building department in 1890, but it was not opened for want of accommodation."

Happily this has now changed and there are four special schools of building in London: at the Polytechnic, Regent Street; the Northern Polytechnic, Holloway; the London County Council School of Building at Brixton; and the L.C.C. School of Building recently opened at Hammersmith. All these schools have evening classes and—with the exception of Regent Street Polytechnic, which has only a senior course—conduct Junior, Senior, Day Schools, and part-time day classes. Besides these four main schools there are nine technical institutions with evening departments providing instruction in branches of the building industry.

A statement of the early history of technical education is given for each of the building trades.

NATIONAL CERTIFICATE AND DIPLOMA SCHEME IN BUILDING TECHNOLOGY

The Institute of Builders, in conjunction with the Board of Education, awards certificates and diplomas in general Building Technology to students who have successfully attended approved Technical Schools or Colleges and passed the Final Examinations which are conducted under approved conditions. The Certificates are awarded in respect of part-time grouped courses of instruction and Diplomas in respect of full-time grouped courses.

This Scheme is similar to the National Certificate Schemes for Electrical and Mechanical Engineering, explained under Engineering and Metal Trades, p. 62.

The first examination was held in 1931 when 754 candidates presented themselves from 70 Schools, and 471 were awarded certificates and diplomas as follows: 358 Ordinary Certificates; 94 Higher Certificates; 11 Ordinary Diplomas; 8 Higher Diplomas.

III

BRICKLAYING AND MASONRY

In 1874 the first classes for bricklayers were opened at the Artisans' Institute, St. Martin's Lane, and at the Club House of the Operative Bricklayers' Society, in Southwark Bridge Road; the former class being taught by W. Woodley and G. Berry, and the latter class by W. Peach Morris. These three teachers were bricklayers who had attended science classes and become General Foremen and later Clerks of Works. A stimulus to the early classes was given by the demand for bricklayers skilled in brickcutting for the Lawrence, T.L.B. bricks, which were being used in the ornamental red brickwork of houses being built in the Queen Anne style at that time on the Chelsea Embankment and elsewhere. Colonel Stanley Bird, who took a great interest in classes for bricklayers, stated in his letter to *The Times*, December 29th, 1882, " that a great want of competent tilers and bricklayers exists and was felt when the Queen Anne style was revived."

The class at the Artisans' Institute was transferred in 1881 to rooms in Cowper Street Schools and was taught by J. Channon, and a class was opened later at the Regent Street Polytechnic. These two classes were in 1886 taught by H. W. Richards, who became Principal of the London County Council School of Building at Brixton. Other classes were opened at the Westminster Technical Institute in 1890; the Borough Polytechnic, 1892; the

Battersea Polytechnic, 1894; the Northern Polytechnic, Holloway, 1896; and the Manchester Technical School and University College, Nottingham, in 1885.

The introduction in 1886 of an examination in Brickwork and Masonry was a great stimulus to the formation of classes in this subject in technical institutes in the country where building classes were held. In 1897, 293 candidates sat for examination in brickwork and 30 passed in the Final and 149 in the Ordinary grade; in 1898, there were 397 candidates, of whom 44 passed in Final and 259 in Ordinary grade. In 1931 the number of candidates was 155, of whom 49 passed in Part I and 26 in Part II of the Final grade.

MASONRY.—A class for masons, taught by W. Wall, a foreman mason, was also held at the Artisans' Institute, quite distinct from the bricklayers' class, as it should always be if it is to be of any real assistance to masons. This was referred to in the London County Council Building Report of 1899. At first the trades, Brickwork and Masonry, were treated as one examination subject by the City and Guilds of London Institute in 1886, and classes in the early days were taught by and were attended mainly by bricklayers as they were unsuitable for masons, who required a practical mason for a teacher. Masonry has now been separated from brickwork in the City and Guilds of London Institutes Examination; it was made a separate subject under a special examiner in 1897. Special classes taught by masons are now held in technical institutes in London and principal towns throughout the country. For the City and Guilds Institute examination in 1897 there were 188 candidates, of whom 24 passed in the Final and 100 in the Ordinary grade; in 1898, the candidates increased to 259, of whom 35 passed in the

Final and 154 in the Ordinary grade. In 1931 the number of candidates who sat for Final grade was 33 and 13 passed.

There is an Advisory Committee for Brickwork and Masonry on which are represented the Worshipful Company of Masons, the Institute of Builders, the North-Western Federation of Building Trade Employers, the London Association of Master Stonemasons, the Board of Education, the City Guilds Institute, and the three Associations of Technical Institutions, Principals and Teachers.

TECHNICAL COLLEGE, FINSBURY

(see p. 14)

SESSION 1882–3

The following Special Courses of Evening Lessons, covering a period of two years, have been arranged for Apprentices, Journeymen and Foremen engaged in

BRICKLAYING WORK

First Year's Course

1. Technical Drawing.—The Drawing and Methods of obtaining the Joints and Bevels of Gauged Arches.
2. Explanation of the terms, the description and proper use of the tools used in Bricklaying and Brickcutting; the nature and properties of Bonding Foundations, Walls, Moulded Cornices, Chimney Shafts, etc.
3. Freehand Model Drawing.
4. Practical Geometry.—Elementary Class.
5. Practical Mathematics, Elementary.—The use of Mathematical Tables, the Slide Rule, Squared Paper, Formulas, Mensuration, Taking out Quantities, etc.

Second Year's Course

1. Technical Drawing.—The application of Geometry to Brickwork, and the methods of obtaining and applying Moulds, Templates, and Bevels by setting out in detail Elliptical and Oblique Arches, Domes, Niches, Groins, Raking Mouldings, Firework, Tunnel and Sewer Construction, Moulded Panels, Finials, etc.
2. Drawing, as applied in the Trade.
3. Practical Mechanics.

Students may attend any one or more of the above Classes, but they are strongly recommended to attend the complete course for each year as indicated.

Apprentices admitted at half the ordinary fees.

IV

CARPENTRY AND JOINERY

The technical education of carpenters and joiners was helped by books written by P. Nicholson, before 1812, in which Geometrical Construction and Practical Carpentry were dealt with, and by the work of T. Tredgold on Carpentry and principles of mechanics relating thereto, printed in 1820 for J. Taylor, at the architects' library, 59 High Holborn, who also published Nicholson's books.

The first definite technical class for carpenters and joiners, in which the applications of geometry to the trade were illustrated by practical work, was opened at the Artisans' Institute in 1874 and was taught the first year by R. Williams, next by J. James, foreman carpenter, followed by H. Staynes.

Classes were opened in 1878 at Croydon and Clapham Junction, with the aid of a special grant from the Drapers' Company. The former class was taught first by J. King, foreman carpenter, and next by H. Staynes, and the Clapham class by J. James. In 1881 the class at the Artisans' Institute was transferred to the Cowper Street rooms, and taught by H. Staynes, and a class was opened by W. J. Pope at the Regent Street Polytechnic in 1882. Classes were opened at the Westminster Technical Institute, 1890; Goldsmiths' Institute, 1891; Borough Polytechnic, 1892; Titchfield Street Schools, 1893; Battersea Polytechnic, 1894; Chelsea Polytechnic, 1895; Northern Polytechnic, 1896; Northampton Polytechnic, 1897; the Manchester Technical School in 1884, and University College, Nottingham, 1885. In the Technical Institutes and Colleges in Liverpool, Leeds, Huddersfield, Halifax, Birmingham, Leicester, Glasgow, Edinburgh and other towns classes have been opened in this subject since the first class in 1874.

The City and Guilds of London Institute held its first examination in 1884, and that gave a great impetus to the opening of classes which are evidently much appreciated, as shown by the fact that in the 1931 examination, 626 candidates sat for, and 323 passed in the Final grade and 54 passed the Inter. In 1897 there were 860 candidates of whom 402 passed the Ordinary and only 45 the Honours grade examination. In 1898 the number of candidates increased to 978 and 409 were successful in the Ordinary and 64 only in the Honours grade.

In order to encourage excellence of craftsmanship the Institute of Builders offers a First Prize of £5 and Silver Medal, and a Second Prize of £3 and a Bronze Medal, to those candidates who obtain the highest marks in the Final Examination in the United Kingdom, and who also obtain a first class in the written portion of the Final Examination—provided they are British subjects and are engaged in the craft and not acting as teachers in this or any allied subject. Under the same conditions the Institute of Builders also offers a Silver and a Bronze Medal (without money prizes) to those Candidates in the Overseas Dominions, Colonies or India who would have received prizes if they had taken the examination in the United Kingdom.

In connection with the examination there is an Advisory Committee on which are Representatives of the Worshipful Company of Carpenters, the Incorporated British Institute of Certified Carpenters, the Institute of Builders, the Board of Education, the City and Guilds of London Institute and the three Associations of Technical Institutions, Principals, and Teachers.

The Worshipful Company of Carpenters gives a course of five lectures at their Hall and holds an Examination in Carpentry and Joinery, intended for Shops and Out-door Foremen in Carpentry and Joinery, Clerks of Works and others who have to deal with the Construction of Buildings.

Certificates bearing the Company's seal are awarded to successful Candidates and a register of them is kept at Carpenters' Hall. Gold, Silver and Bronze Medals are awarded for distinction and the Clerk of Works Association offers £5 5*s*. for prizes.

THE INCORPORATED BRITISH INSTITUTE OF CERTIFIED CARPENTERS

This Institute, first known as the Institute of Certified Carpenters, was formed in 1890 as the result of a Conference of the successful candidates at the Examinations held by the Worshipful Company of Carpenters. In 1903 it was Incorporated and its name changed to its present title.

The first Presidents were W. W. Pocock, F.R.I.B.A., Professor Bannister Fletcher, F.R.I.B.A., Professor T. R. Smith, F.R.I.B.A., and J. Williams, J.P. The present President is F. Adams Smith, F.R.I.B.A., and all the Presidents were Past Masters of the Carpenters' Company.

The object of the Institute is: "To promote the well-being and general interest of its members by mutual improvement, the reading of papers, lectures, visiting Works, and the publication of a Journal."

Meetings are held monthly at the Carpenters' Hall by kind permission of the Worshipful Company of Carpenters.

There are two classes of Membership—Fellows and Associates, and the qualification for either class is that Candidates must be twenty-one years of age, have worked as a Carpenter or Joiner for at least five years and, in addition, have passed the following examinations:

FELLOWS must hold either a First Class Certificate in the examination held by the Carpenters' Company in Carpentry and Joinery. Or—A pass in the Carpenters' Company examination and a pass in the examination for Associateship conducted by the Institute of Certified Carpenters. Or—A First Class Final Grade Certificate in Carpentry and Joinery of the City and Guilds of London Institute, and a pass in the Carpenters' Company examination.

ASSOCIATES must have passed either the Worshipful Company of Carpenters' examination in Carpentry and Joinery. Or—Passed the Associate examination of the Institute of Certified Carpenters. Or—have passed the City and Guilds of London Institute, Final grade, examination in Carpentry and Joinery.

The present membership is 900, and recently a students' section has been formed for young men between the ages of eighteen and twenty-five years upon producing satisfactory evidence of study.

TECHNICAL COLLEGE, FINSBURY

(see p. 14)

SESSION 1882–3

The following Special Courses of Evening Lessons, covering a period of Three Years, have been arranged for Apprentices, Journeymen and Foremen engaged in

CARPENTRY AND JOINERY

First Year's Course

1. Technical Drawing.—The application of Geometry to Carpentry and Joinery as required in the formation of Joints, Mouldings, Cornices, etc. The practical setting out and working from drawings.
2. Practical Geometry.—Elementary Class.
3. Freehand and Model Drawing.
4. Practical Mathematics.—Elementary.

Second Year's Course

1. Technical Drawing.—The application of Geometry to Carpentry and Joinery in enlarging and diminishing Mouldings, Raking Mouldings, and in the construction of Hip-Roofs, Skylights, Groins, Niches, Bracketing for Coves and Cornices, Soffits, Circle upon Circle, Staircasing, etc.
2. Drawing, as applied in the Trade.
3. Practical Geometry.—Advanced.

Third Year's Course

1. Technical Drawing.—A more advanced course of the second year's work, including Handrailing, etc.
2. Ornamental Design.
3. Mechanics and Machine Design.

The Students have the opportunity of carrying out their own drawings, and of seeing practically illustrated the principles of Carpentry and Joinery in the College workshops.

Students may attend any one or more of the above Classes, but they are strongly recommended to attend the complete Course of Instruction as indicated for each year.

Apprentices admitted at half the ordinary fees.

V

PLUMBING

Technical education for the Plumbing Trade may be said to have begun with the interest taken in House Sanitation, owing to the public belief that many of the ills to which flesh is heir were due to the insanitary conditions produced by the effects of bad plumbing. The attention of the Worshipful Company of Plumbers was called to the training of plumbers in 1875 by George Shaw, Master Plumber and a Member of the Court of the Company, who pointed out the numerous complaints, appearing almost daily in the newspapers, of bad plumbing in houses and of the serious evils arising therefrom.

In November, 1875, a Committee was appointed "to inquire into and report to the Court how far technical education can be promoted among the workmen of the Trade, and to ascertain the mode or modes by which it can be best attained."

A Report was drawn up by G. Shaw and presented at a special Court on the 24th May, 1876. The Report was approved and the committee was authorized to continue its sittings, but no action was taken on the Report. This induced Mr. Shaw, on becoming Master of the Company in September, 1878, to prepare and publish a pamphlet, entitled, *Revived Guild Action.*

On the 25th April, 1879, a Committee was appointed, consisting of the Master (G. Shaw), who was then Chairman of the City Lands Committee of the Corporation, Digby Seymour, Q.C., and P. Wilkinson, F.R.I.B.A., to consider and report to the Court as to the best means of extending the utility of the Company, and of elevating the character and educational standard of the workmen engaged in the trade of plumbing.

The recommendations of this Committee, which were agreed to at a special meeting of the Court on the 18th May, 1879, were as follows, viz:

> " That the freedom of the Company be given to competent working plumbers of fifteen years' standing, and Diplomas under the Company's seal to workmen who have followed the trade for at least ten years, and who can give satisfactory certificates of ability and personal character."

These resolutions, however, being unaccompanied by any form of examination, led to no practical results.

In the meantime the City and Guilds of London Institute had been established, and in 1881 Mr. Shaw was appointed Examiner in Plumbing and Zinc and Tin-Plate Work. On account of the difficulty of combining these trades in one Examination the subjects were separated in 1882, and Zinc and Tin-Plate Work were extended to an Examination in Metal-Plate Work generally.

On Mr. Shaw's suggestion, the Plumbers' Company agreed that those who succeeded in passing the examination in plumbing in Honours should be eligible to receive the Freedom of the Company.

This was really the first practical step towards the Registration of Plumbers; but until the institution, at the Finsbury Technical College, of Plumbing Classes, with later a special work-shop and laboratory, the first of its kind in this country, no practical examinations were held.

On the 21st September, 1884, Mr. G. Shaw, as Master of the Plumbers' Company, succeeded in obtaining the Company's sanction to the use of its name for the training and registration of plumbers. A meeting of representatives of the plumbers' trade was held at Guildhall on September 26th, 1884, to consider what action should be taken. After considerable discussion a resolution was passed, requesting the Plumbers' Company to communicate with the National Health Society and the Sanitary Institute, with the object of arranging a Conference of Metropolitan and Provincial Plumbers to be held at the International Health Exhibition, South Kensington, towards the end of October 1884. The subjects suggested for consideration were:

1. Technical Instruction of Plumbers.
2. Apprenticeship.
3. Establishment of Metropolitan and Provincial Boards of Examiners in Plumbers' Work.
4. The Registration of Plumbers.

The Conference, under the presidency of Mr. George Shaw, was held in the Lecture Theatre of the City Guilds Central Institute, South Kensington, on the 20th and 21st October.

The attendance was large, including master and journeymen plumbers from various London districts, provincial representatives nominated by the Mayors of most of the large towns, medical officers, sanitary inspectors, surveyors, architects and other professional gentlemen, amongst these being Ernest Hart, Chairman of the National Health Society, G. H. Guillaume, of the Society of Architects, F. C. Penrose, of St. Paul's Cathedral, Dr. Vacher, of Birkenhead, and others. Papers were read by Ernest Hart on "The Regulation and Registration of Plumbers"; by C. T. Millis on "Technical Education for the Sanitary Plumber"; by W. Eassie, C.E., on "Apprenticeship"; by W. R. Maguire, of Dublin, on "Indentures suited to the Modern System of Technical Education"; by J. W. Clarke, on "The Value of Practical Work in Technical Training"; by W. Webb on the "Suitability of Materials used by Plumbers"; and by W. R. E. Coles (Clerk of Plumbers' Company) on the "Desirability of a System of Uniformity in the Quality of Materials used in Plumbing." Other papers on matters relating to the value of "A System of Registration of Plumbers" were read by J. Smeaton, E. Knight, P. J. Davies, and other leading members of the Trade, Masters and journeymen.

Discussions followed the reading of the papers and resulted in the following resolutions, among others, which were carried unanimously:

(1) That in the opinion of this Congress, it is desirable that the Apprenticeship System should be continued, modified if necessary to suit the improved course of technical education.

(2) That this Congress is of opinion that in the event of the establishment of Provincial Boards of Examiners of Plumbing Work, such Boards—

(*a*) Should be affiliated with a Metropolitan Board.

(*b*) Should consist largely of trained working plumbers.

(*c*) Should be in connection with Provincial Schools of Plumbing.

(3) That in the opinion of the Congress the registration of master plumbers and journeymen is expedient.

(4) That the resolutions, recommendations, and conclusions set forth in the preceding papers be referred to the Plumbers' Guild, with a request that they will confer

thereon with a view to taking such action as may seem best.

The result of resolution (4) was the calling together of a committee of representative men by the Plumbers' Company. The first meeting of this Committee or General Council, as it was then called, was held on 31st July, 1885, at Guildhall, under the presidency of Earl Fortescue. It was fully attended and a number of resolutions were passed. A meeting of the London Trade was held at Guildhall on 25th January, 1886, at which the resolutions passed at the Guildhall meeting of July, 1885, were explained by the Chairman, G. Shaw, who moved " That the Plumbers' Company open forthwith a Register for Plumbers (Masters and Journeymen)." This was unanimously agreed, and the system of National Registration of Plumbers duly inaugurated. It is estimated that the Plumbers' Company has spent between £30,000 and £40,000 in promoting this movement.

The first members of the Registration Council were: *G. Shaw (Chairman), Messrs. W. H. Bishop, *C. H. Hudson, W. Dent, P. Wilkinson, F.R.I.B.A., W. Digby Seymour, Q.C., Alderman (afterwards Sir) Stuart Knill, and F. Machin, representing the Worshipful Company of Plumbers; Messrs. *J. C. Ashdown, J. Hume, *J. Smeaton, R. Smith, *W. H. Webb, *J. W. Titmas, S. S. Hellyer, G. Clegg, P. J. Davies, D. Emptage, W. D. Scott-Moncrieff, *H. B. Lobb, Master Plumbers; Messrs. J. R. Beeston, J. Browning, *L. F. Gilbert, *R. J. Lyne, *R. A. Nurse, W. Firth, S. Cornwall, J. Smith, Journeymen; and *G. Davis, J. W. Clarke and *G. Taylor, Foremen Plumbers (the two last being teachers of Plumbing); Dr. Vacher, M.O.H., J. A. Hardcastle, M.P., together with Sir Philip Magnus and *C. T. Millis representing the City and Guilds of London Institute.[1]

The following account of the first examination of candidates for Registration may be of interest:

PLUMBERS' WORK

"On Saturday the City and Guilds of London Institute, Finsbury, was in a state of activity from the fact that a number of plumbers were undergoing examination by the examining body appointed for the purpose of testing plumbers for admission to the Register of the Plumbers' Company. Besides the board of examiners there were present: The Master of the Company (Mr. G. Shaw, C.C.), Mr. Alderman Knill (prime warden) and Mr. C. T. Millis of the Technical Institute. The examinations were directed to testing the applicants in the practice as well as technology of plumbing. It will be remembered that the Company state, under clause 6 of their conditions, that 'All applicants who cannot satisfy the Registration Committee of their experience are required to pass an examination by a board of examiners composed largely of practical plumbers.'" (*City Press*, September 1st, 1886.)

The outcome of the formation of the Registration Council and establishment of a system of Registration of Plumbers was the early application of a large number of Master Plumbers and Journeymen, from London and the provinces, to be registered by the Plumbers' Company and to use the letters R.P.C. after their names. As a number of applicants had to pass an examination held by the Company, that fact, together with the examinations of the City and Guilds of London Institute, gave a great impetus to the technical education of plumbers and led to the establishment of classes throughout the country. Some idea of the progress and provision for technical education for Plumbers may be gained from what follows.

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[1] Those whose names are marked * were the first examiners appointed.

Classes for Plumbers' Work were in existence at the Regent Street Polytechnic and the Finsbury Technical College, and in the Session 1884–5 the number of students in attendance at plumbing classes registered and examined by the City and Guilds of London Institute was 145 and the number of classes only five. In 1885 classes were opened at the Manchester Technical School, Merchant Venturers' School, Bristol, and the Leicester Technical School; the number of students increased from 145 to 329 and the number of classes was more than doubled. In 1886 the students numbered 403 and the classes eighteen. According to a return of the Board of Education in 1928, the number of classes held per week in England and Wales was 627, with a class (*not individuals*) enrolment of 10,846.

Full-time Day Courses of instruction are provided in four Junior Technical Schools in London and Middlesex and Senior Courses at the Manchester College of Technology, and combined day and evening courses at the Central Technical College, Leeds, in conjunction with the Leeds and District Master Plumbers' Association.

In 1885, 87 candidates sat for examination, and 210 in 1886. The first practical examination was held in 1887 under the direction of Mr. S. S. Hellyer (Dent & Hellyer), the Institute's Chief Examiner in Plumbing, and out of 257 candidates who sat for the written examination, 128 submitted themselves for the practical test. Examinations were held at Manchester, Nottingham, Preston, Leicester, Bristol, Cardiff and at two centres in London. The number of candidates in 1897 was 1,357, of whom 166 passed in the Final and 344 in the Ordinary grade.

By arrangement between the Board of Education and the City Guilds Institute, examinations in the Final grade only in England and Wales are now held by the Institute.

The examinations were divided into two courses in 1922: (1) A Minor (now Ordinary) Course in Plumbers' Work intended to meet the requirements of apprentices and of many students attending evening classes, and (2) a Major (now Advanced) Course in Plumbers' Work and Sanitary Engineering suitable for the more advanced students of evening classes, for students attending full-time day classes, and for others who desire to qualify for the higher positions in connection with plumbers' work and sanitation.

In 1923 there were 143 candidates for the Final grade examination of the Minor Course and 72 for the Major Course, and of these 57 passed the Minor and 49 the Major Course respectively.

In 1931 the number of candidates who sat for the Final Examination in the Ordinary Course was 501, of whom 321 passed. There were 79 candidates for the Final examination in the Advanced Course of whom 69 passed, and it should be noted that candidates in order to qualify for this examination must possess the Institute's Certificate in the Final grade of the Ordinary Course in Plumbers' Work.

The Institute of Plumbers, which was founded in 1903 and has for one of its objects the advancement of the trade by the encouragement of education and apprenticeship, offers a Silver Medal as a First Prize and books on plumbing to the value of £2 *2s.* as a Second Prize upon the results of the Final Examination in the Ordinary

Course to candidates who obtain the highest marks in the practical tests and pass the written examination.

The United Kingdom Lead Manufacturers' Association offers £3 as First Prize and £2 as Second Prize to candidates resident in England and Wales who obtain the highest aggregate marks for written and practical work in the Final Examination Ordinary Course.

In order to minimize the duplication of examinations as far as possible by making use for Registration purposes of those of the City Guilds Institute, an Advisory Committee on Plumbers' Work was appointed to the City Guilds Institute in 1906, on which were three representatives each of the Worshipful Company of Plumbers, the City and Guilds of London Institute, the Institute of Plumbers, and the United Operatives' Association, together with one of the Board of Education Inspectors as Chairman. This Committee has recently been enlarged by representatives of the Associations of Technical Institutions and Teachers in Technical Institutes and Regional Examining Bodies.

One beneficial result of the formation of the Advisory Committee is that the National Registration Council for Plumbing accepts the Final grade Certificate of the City Guilds Institute in either the Minor or Major Courses as a full qualification for admission to the Register of Plumbers, provided the holder furnishes to the Council satisfactory evidence of adequate practical training in an employer's workshop and is not less than twenty-one years of age.

Resolution No. 1 (p. 34) of the Plumbers' Congress in 1884 has now borne fruit. A Plumbing Trades National Apprenticeship Council has been established, consisting of 6 Master Plumbers, and 6 Operative Plumbers, 4 of whom are nominated by the United Operative Plumbers' Association and 2 by the National Registration Council. There are also representatives of associated interests such as the Ministry of Labour, Board of Education, Worshipful Company of Plumbers, Royal Institute of British Architects, Royal Sanitary Institute, Water Works Engineers and Association of Technical Institutions. The Council meets in the Board Room of the Institute of Plumbers.

A scheme of Apprenticeship was drawn up by the Council in 1920 and amended in 1925. The introduction to this scheme states that it "aims at the thorough training of every boy entering the trade, ensuring both that the employers shall see that he has a grounding in the practical processes of the craft, and that by attendance at a Technical School he shall acquire an understanding of the processes themselves, and include in the range of his knowledge other branches of craft which the employers may not have facilities to teach."

It was proposed that besides the National Council there should be Areal Councils, covering about 12 areas such as (1) London and a radius of 20 miles; (2) Northumberland, Durham, Cumberland, Westmoreland; (3) Manchester and Preston with 20 miles radius, and other parts of the country similarly divided.

It was some time before the scheme came into operation, but in the last reports received by the Council there are some 424 indentured apprentices under the Scheme —N.E. Coast 261, N.E. Lancashire 99, London 64—and of these 111 have completed their training. The Form of Indenture provides that full-time attendance at a technical school, approved by the Council, may be counted as part of the period of apprenticeship.

With the exception of a book on Plumbing by Buchan, articles on Plumbers' Work by P. J. Davies and J. W. Clarke, in the *Plumber and Decorator*, and the reports of S. S. Hellyer's Society of Arts Lectures, there was practically no literature on the subject in 1881. There is now a long list of books of reference in the City Guilds Institute's Programme, too long to give in detail. The authors are authorities on the subject such as P. J. Davies, J. W. Clarke, Herring Shaw, J. W. Hart, R. H. Bew and others.

The following particulars of Examinations in Sanitary Building Construction though not directly connected with Plumbing are given here.

THE WORSHIPFUL COMPANY OF CARPENTERS

Examinations in Sanitary Building Construction

These Examinations are suitable for Clerks of Works, Builders' Foremen and others who have to deal with the Construction of Buildings.

For the benefit of Candidates who propose to attend the Examination a course of Lectures has been arranged, and are given at the Carpenters' Hall preceding the Examination. Tickets of admission will be supplied on application to the Clerk of the Company.

The Examination will occupy parts of a Thursday and Saturday. On the Thursday, the Examination lasts four hours—from 5 to 7 p.m., and from 7.30 to 9.30 p.m., and consists of written papers only. On the Saturday the Examination commences at 12 noon, and will be *vivâ voce*, with one or more questions in writing if deemed necessary.

Gold, Silver and Bronze Medals are, at the discretion of the Examiners, awarded to the Candidates whose work entitles them to such distinction.

A Certificate, bearing the Seal of the Carpenters' Company, will be granted to each successful Candidate.

A Register of the successful Candidates is kept at Carpenters' Hall and may be referred to by Architects, Builders and employers.

Syllabus of Subjects for Examination

General knowledge of materials used in Building—

(*a*) The properties and qualities of Bricks, Stone, Lime and Cements ; methods of making and using Mortar, Cement and Concrete.

(*b*) Nature and properties of Timber, its decay and preservation.—Sanitary precautions as to Healthiness of Site and the sufficiency of Air-Space about Buildings. Construction of Foundations, especially when the bottom is bad or under water. Methods of Bonding Brick and Stone Work. The Principles to be observed in the construction of Walls, Floors and Roofs, with especial reference to warmth and dryness. Hollow Walls. Sanitary Arrangements of Buildings, the construction of Water Closets, Privies, and Dry Closets, Water Supply, Water Tanks and Services, and Plumbers' Work. The Essentials and Details of Good Drainage ; the various kinds of Pipes, Pipe laying, Ventilation of Drains and Testing of Drains. The advantages and disadvantages of various Sanitary Appliances used in Buildings. Principles of Ventilating and Warming Buildings. Principles of Calculating Areas, Cubic Space ; interpretations of Drawings to scale ; Methods of Setting out Work, Checking Levels. Knowledge of the Acts of Parliament relating to Buildings. The Model Bye-Laws issued by the Local Government Board, so far as they relate to subjects of the Examination.

VI

PLASTERERS' WORK

It is a little difficult to trace the beginning of the movement for the technical education of plasterers, but it is believed that one of the earliest efforts was a conference of plasterers at the Borough Polytechnic Institute in 1893 at which Mr. H. Broadhurst, M.P., was present, and the Secretary of the Plasterers' Union spoke of the value and necessity of something being done in the way of education for that trade and to remedy the deficiency of apprentices. Owing to the want of accommodation no class was then practicable at the Borough Polytechnic, but the meeting resulted in a class for plasterers being started at the Battersea Polytechnic in 1894, probably the first class of its kind in London. This was followed by a class at Titchfield Street supported by the Plasterers' Company and at several of the Polytechnics. Mr. George Cole, secretary of the London district of the National Association of Operative Plasterers, who had given great assistance in the opening of classes for plasterers, in his evidence before the London County Council Committee on building trades, said:

"We have in our society a system of registration. Five years ago I approached the masters and found there were no boys in the trade, and there were no builders affording any facility for them. We appointed a committee to investigate the matter and the committee came to the conclusion that it was owing to the lack of the apprenticeship system. The masters would not hear of having apprentices, and in consequence this system of registration was instituted. We make efforts to find the boys employment. At the present time we have no less than 290 boys under 18 years of age who are learning the plastering trade."

In 1896 the City and Guilds of London Institute held an examination in Plasterers' Work which helped to keep up interest in the subject, and many classes are now held in Technical Institutes in London and in the provinces where Building Trade classes exist. The Worshipful Company of Plaisterers offer prizes on the results of these examinations, £8 for a First, and £7 for a Second Prize in the Final grade; and £5, £3, and £2 respectively for First, Second, and Third Prizes in the Intermediate grade. In connection with the examination there is an Advisory Committee on which are representatives of the National Association of Plasterers, Granolithic and Cement Workers, National Association of Master Plasterers, the City Guilds Institute, Board of Education and the L.C.C. School of Building.

In 1897 there were 20 candidates, of whom 10 passed; in 1898, 40 candidates and 17 passes; and in 1931; 76 candidates, of whom 57 passed in the Intermediate and Final grades.

VII

HOUSE PAINTING AND DECORATING

House painters and decorators were desirous of obtaining some instruction in their trade as early as 1873, but at first they had only the Art Classes of the Science and Art Department to depend upon, which, though useful at the time, were not quite what they wanted for their work. One of the first Workmen's Clubs—in Newman Street, Oxford Street—was started at the instigation of house painters. It was called the House Painters' and Decorators' Club and its promoters had hoped to hold a class there.

George Shipton, Secretary of the House Painters' and Decorators' Trade Society and Secretary of the London Trades Council, who was interested in this club, was one of the witnesses before the Royal Commissioners on Technical Education, on the 23rd February, 1883. The following extract from his evidence is of interest as it illustrates some of the difficulties these workmen had, at that time, in obtaining instruction suitable for their trade.

He said:

"About twelve years ago, I went, with some workmen, with the intention of forming a class at the West London School of Art . . . and there we found that the subjects taught were not of the least practical value to us as painters and decorators. The whole of the instruction was too elaborate and artistic, and meant a long course of study and practice, impossible and useless for us to try. Had we attempted it, we might at our time of life become 'mongrel artists' and have been spoiled as workmen.

On my pointing this out to the Headmaster, Mr. Stewart, who, by the way, was a practical house decorator as well as a teacher, he was so impressed with my representation that he gave us a separate room apart from the regular School of Art, in which we received two lessons a week at the rate of 12*s*. each. One lesson was given by himself upon the harmony of colour for practical house painting and decorative purposes, treating of work which it would fall to the lot of the operative painter to execute."

As some of the members of the class were called away to work in other parts, the cost of these classes for those who remained became too heavy, and with great regret they had to be given up.

The next attempt at forming a special class for house painters was made at the Cowper Street rooms in 1881. This class was taught by H. L. Ramsay, an Art Master and Decorator, who conducted Art Classes at the Artisans' Institute in 1879, and at Regent Street Polytechnic in 1882. When the Applied Art Department at the Finsbury Technical College was ready in 1883, a class for painters and decorators was opened by W. Fourness, who had practical experience of the Painting and Decorating trade. Nothing much appears to have been done, with the exception of a number of useful articles written on the subject in the Trade Journals, *The Journal of Decorative Art* and *The Plumber and Decorator*, until 4th March, 1891, when W. G. Sutherland of Manchester (a Decorator, and Proprietor of the *Journal of Decorative Art*, read a Paper on "Technical Education and the Painting Trade," before the Court of the Painter Stainers' Company in their Hall in London. In this Paper he said:

> "I feel confident that were any movement organized—and on the right lines—having for its objective the wider dissemination of sound knowledge and instruction for the trade, it would be eagerly taken up and supported by those for whom it is intended."

He further spoke of the value of establishing an Institution, Guild, or Society in London, with affiliated branches all over the country, and outlined very briefly the scope of operations of such an organization. In conclusion, he said that if after due consideration the Court decided to move in the matter, the initial stage would be the summoning of a conference of the trade, both masters and men, some time in the late autumn to discuss the whole scope and reference of the proposed society. The Paper was printed by order of the Court and it was unanimously resolved:

> "That this Court, having listened with much interest to Mr. Sutherland's remarks, thanks him for having so ably expressed his general views as to the Technical Education of Painters, and undertakes to carefully consider his proposal for a conference to be held in the Autumn in this Hall."

A conference was held in the Painter Stainers' Hall on the 16th, 17th, and 18th January, 1893, when the Master of the Company presided on the first evening, Colonel R. J. Bennett (Glasgow) on the second, and J. D. Crace on the third evening. Papers were read on "The Need of Better and More Systematic Training on the part of Members of the Trade," by W. G. Sutherland; "How best to Stimulate an Interest in our Trade on the part of the Young," by Thos. Lough, M.P., and W. A.

Steward, L.T.C.; "Is it desirable to revive the Apprenticeship System," by J. Clarke, Edinburgh, and H. McCulloch, Glasgow; "Trade Classes and their Management," by C. T. Millis and W. Fourness; "Is it desirable to establish a System of Registration and to grant Diplomas or Certificates of Ability," by L. Laing and G. Kilpack; "Conferences and Exhibitions, their Value to the Trade," by J. Jameson and A. Purser; and "Proposals for Establishing a new Organization," by A. Chappell and A. Caiger.

A meeting of the Trade was also held at the Borough Polytechnic Institute on 18th December, 1893, and a class for decorators was opened at the Battersea Polytechnic in 1894.

Classes in this subject were afterwards opened in other Polytechnics in London. At the Heriot Watt College a class had been started in 1893. Walter J. Pearce, who was associated with Mr. Sutherland in the *Journal of Decorative Art* and an enthusiast for the technical education of painters and decorators, after negotiations with the City Corporation in 1892–3, opened a class for painters and decorators in the Art Gallery, Manchester, in 1894. The class was later held at the Technical School and at present is in the Municipal School of Art. Classes for painters and decorators were opened about this time in Sheffield and Birmingham; and are now held in many technical institutes throughout the country.

The City and Guilds of London Institute held its first examination in Painters' and Decorators' Work in 1896. In connection with these examinations, there is "The International Advisory Committee," consisting of representatives of the National Federation of Master Painters and Decorators, Scottish Painters' Society, National

Federation of Master Painters in Scotland, Painting Craft Teachers' Association, Board of Education and the Association of Teachers in Technical Institutions. The London Master Builders' Association offers a First Prize of £3 3*s*. and a Second Prize of £2 2*s*. to those candidates who obtain the highest number of marks for practical work in the Final Examination and have also passed first class in the written examination. In the 1897 examination, out of 172 candidates, 33 passed in the Final and 84 in the Ordinary grade; in 1898, there were 188 candidates of whom 24 passed in the Final and 109 the Ordinary grade. In 1931 the number of candidates was 127, of whom 60 passed the Final.

In the 1924 Report on the Work of the Department of Technology of the City and Guilds of London Institute, it is stated that:

> "Upon the advice of the International Education Committee of the Painters' and Decorators' Joint Council of Great Britain, it has been made a condition of entry to the Institute's Final Examination in Painters' and Decorators' Work that the candidate should show that he has had at least five years' training in the subject, obtained either in a trade workshop or in a recognized school whereat painting and decorating are taught, or partly in a workshop and partly in a school; by this requirement it is hoped to ensure that an apprentice or young workman shall have had an adequate practical training before he presents himself for the Final Examination."

A deputation from the Association of British House Painters to the Painters' Company in May, 1897, may be regarded as one of the results of the January, 1893, Conference, and in 1899 the Incorporated Institute of

British Decorators was founded, which has its Headquarters at the Painters' Hall, London. For the Associateship, the Institute holds examinations in three grades—Preliminary, Intermediate and Final, candidates being exempt from the Preliminary if they have passed certain school examinations, and from the Intermediate if they hold the full Technological Certificate of the City and Guilds of London Institute in Painters' and Decorators' Work. Mr. J. D. Crace was the first President of the Institute, the membership of which consists of three classes, (1) Fellows, (2) Associates and (3) Honorary Members. One essential qualification for the first two classes is that a candidate must have had a regular training in the craft of decoration.

There are competitions for Travelling Scholarships, and an Award of Books; in 1930 the Sixty Guinea Travelling Scholarship was won by a student at the Central School of Arts and Crafts; the Junior Travelling Scholarship, and the Award of Books were won by students of the Northern Polytechnic, Holloway. The Secretaryship in the Division of Decoration of the School of Architecture at University College, London, was founded with the assistance of the Institute.

VIII

BUILDERS' QUANTITIES

A description of education in the building trades would not be complete without the mention of the subject of Builders' Quantities, not to be confused with the work done by Surveyors. It is a most useful subject, which enables builders to estimate. Prior to 1885 when the first class in an Institution was opened at the Finsbury Technical College under F. G. Minter, instruction in this subject could only be obtained by correspondence and private classes at high fees. An extract from the handbill of the Finsbury Class for Session 1885–6 states :

> "This class has been specially formed for Apprentices, Journeymen, Foremen and others engaged in Bricklaying, Carpentry and Joinery, Masonry, Plumbing, Gasfitting, Painting, Glazing, etc., and will comprise the following: Measuring Work ; Taking off Quantities from Drawings in the various Trades connected with Builders' Work generally ; Squaring the dimensions in proper form and bringing same into Bill ready for pricing out ; Estimating ; Pricing out same to form a Builders' Estimate."

Mr. Minter was an expert quantity surveyor in a large firm of builders, and became one of the biggest builders in London, and a President of the Institute of Builders.

The popularity and usefulness of this subject may be judged by the fact that there are now classes in nearly all the technical institutes in London and the country where building trade subjects are taught. The City and Guilds of London Institute instituted an examination in this subject in 1900, and at the 1931 examination 322 candidates sat, of whom 218 succeeded in passing in the Intermediate and Final grades. The Skinners' Company offers £3 for a First Prize, and £2 10*s*. for a Second Prize in the Final grade in this subject.

An Advisory Committee has been formed on which are represented the Surveyors' Institution, Institute of Builders, the Board of Education, the City Guilds Institute and the three Associations of Technical Institutions, Principals and Teachers.

IX

ENGINEERING AND METAL TRADES

With the exception of Metal Plate Work, which is dealt with separately, it does not seem necessary to write in detail about technical education for each of the branches of the engineering and metal trades as for the different building trades. In the engineering and metal trades, within limits the same type of tools and machines are used, except for pattern making and foundry work, and the materials, steel, iron and non-ferrous metals, are common to all, whereas in the building trades the tools and materials are different for each branch of the industry.

Technical education for engineering may be said to have begun with the introduction of the steam engine and to have progressed alongside of the improvements made by engineers like Bramah, Clement, Rennie, Fairbairn, Maudsley, Penn and others in the slide-rest, planing, milling and other machines for accuracy of workmanship and mass production.

The institution of Professorships in Natural Philosophy at Anderson's College, Glasgow, at Edinburgh, at the Engineering Departments at King's College and University College, London, together with the Papers, Researches and other work of the Institution of Mechanical Engineers, founded in 1847, have materially assisted in building up the present education of engineers. Such education is now very fully developed, especially in its higher branches, and this is largely due to the scientific character of many branches of the Industry and to the close connection between science and its applications to engineering.

The engineers over fifty years ago were fortunate in having books on subjects more or less connected with and useful for engineering, such as Bradley on *Geometry*, Hutton on *Mathematics*, Unwin on *Machine Design*, Willis on *Principles of Mechanism*, Goodeve on *Mechanics*, Northcott on *The Steam Engine*, Rankine on *Thermodynamics*, Cotterill on *Applied Mechanics*, Shelley on *Workshop Appliances*, Anderson on *Strength of Materials*, Kennedy on *Kinematics of Machines*, Fairbairn's Lectures to Engineers, Perry on *Practical Mechanics*, and Percy and Roberts-Austen on *Metallurgy*.

Since 1882 there has been a large output of books on mechanical engineering subjects, and the literature on electrical engineering subjects has developed.

Incidentally it may be pointed out that engineering owes much of its success to two factors ; the one, the early recognition that theory and practice must go together, and the other, the various methods by which engineers have been trained. The methods may be summed up briefly as, either works experience preceding, following or concurrent with scientific and theoretical training. The first procedure has produced some of the most able engineers who have applied their scientific knowledge to engineering problems with excellent results. Two notable early examples are given.

Smiles, in his *Industrial Biography*, states that Joseph Clement, whilst working as a turner at Glasgow, took lessons in drawing from Peter Nicholson, the well-known writer (referred to, p. 25) on Carpentry, and on going to Aberdeen, attended courses in Natural Philosophy and Practical Mechanics at Marischal College. In his *Lives of Engineers* Smiles mentions that John Rennie attended classes in Natural Philosophy at the University of Edinburgh. Both Nicholson and Rennie had been apprentices of Andrew Meikle, Civil Engineer, who invented the threshing machine.

The provision of educational facilities that has been made for technical education for the engineering and metal trades during the century is greater than that for any other industry. The evening classes of the Science and Art Department in Mathematics, Plane and Solid Geometry, Applied Mechanics, Machine Drawing and Steam provided a good supplementary training for the millwright and engineer who had been apprenticed, and the examinations in these subjects were a great incentive to study and enabled numbers of workers to rise to higher positions and do good work as the industry expanded.

The establishment of the Royal College of Science at South Kensington, with the provision of grants to promising students of the science classes and the foundation of the Whitworth Scholarships by Sir Joseph Whitworth, did much for the education of engineers by enabling energetic and ambitious young workmen to continue their education at the College. Many of these students became excellent teachers of engineering subjects.

About 1874, as with other trades and industries, there were feelings amongst working engineers that the evening classes of the Science and Art Department, though useful, were not in themselves sufficient for the growing requirements of apprentices, journeymen and foremen engineers. It was thought that instruction of a more practical and laboratory character, definitely related to engineering and given by men having engineering experience, was needed. This need was confirmed by men like S. S. Taylor, J. Newton (Chairman, London Foremen and Draughtsmen Association), J. Burnett (Secretary Amalgamated Society of Engineers), G. F. Savage (die sinker), and by W. Walker, who was conducting workshop classes at King's College, London, mainly for the instruction of young men intending to go to the Colonies.

A slight attempt to supply this want was made at the Artisans' Institute by opening (with little equipment beyond two or three lathes that had been given) a class for pattern-making and foundry work by D. Williamson (late foreman at Bessemer Bros.), a class for metal turning by Ralph Bonney (turner at Merryweather & Son), a class for wood turners by W. Root (wood turner), and a class in applied mechanics by T. W. Phillips, A.R.C.S., for the engineering students.

A great advance in the development of engineering education, especially of a practical character, was made when the City and Guilds of London Institute was founded in 1878. The Institute introduced examinations in 1881, in Tools (A, Woodworking, and B, Metal-Working), conducted by J. J. Holtzapffel, and in Mechanical Engineering with Professor J. Perry as first examiner. Evidence of the interest taken in these examinations is shown by the number of candidates who sat; for Tools there were 85, and for Mechanical Engineering the number was 471.

Further stimulus was given by special grants made by the Institute in 1880, for three to five years, to

University College, Nottingham; Firth College, Sheffield; and to the Manchester Mechanics' Institute with the object of encouraging local donations and subscriptions for the foundation of engineering departments. These grants were made mainly through the liberality of the Drapers' Company, which made annual grants to the Engineering department of the University of Sheffield for many years, in addition to being responsible for the erection of the new building for the Department of Applied Science at Sheffield, opened in 1912, at a cost of £15,000.

The City Guilds Institute also made special grants to University and King's Colleges, London, for engineering and metallurgy, and supported the City Science Classes in the Cowper Street schools pending the building of Finsbury Technical College.

An important event which merits more than a passing reference was the opening of the City Guilds Finsbury Technical College in 1883, with its day and evening classes in Mechanical and Electrical Engineering. This was the first technical institution in England.

The day classes were intended for pupils from middle and other schools and provided regular and systematic two-year courses for those who, on leaving the College, at a comparatively early age, would at once enter the factory or workshop or some commercial pursuit. These classes would now be described as a Senior Technical Course.

The evening classes were intended for apprentices, journeymen and foremen, and the courses of instruction, arranged for three years, were adapted to the instruction of those engaged in specific branches of engineering.

A special feature was laboratory work, in the well-equipped laboratories, for teaching science allied to engineering. Some of the apparatus was of a type that had formerly been used to illustrate lectures only, but was now to be used for quantitative experiments carried out by the students themselves.

The methods of teaching Practical Mathematics and Practical Mechanics under Professor J. Perry and Practical Physics under Professor W. Ayrton, marked a new era and exerted an influence on the teaching of science over the country.

The opening of the City and Guilds of London Institute Central Technical College (now called the City and Guilds (Engineering) College) at South Kensington in 1884 was another step in the provision of technical education for students desiring to study for the higher branches of science applied to engineering. For the extension of this College in 1909 the Goldsmiths' Company made a grant of £87,000.

The growth of electrical science and its applications to engineering have helped to increase the desire and necessity for engineering education all over the country.

A great change has taken place during the past thirty-five years. The old Science and Art Department classes with the examinations have disappeared and in their stead have risen the fine Technical Colleges, Technical Institutes and Polytechnics, which have well-equipped workshops and laboratories. These institutions provide instruction definitely related to engineering in part-time day and evening classes. There are now courses arranged to suit the requirements of apprentices, workmen and others engaged in all branches of engineering, such as pattern making, foundry work, turning, fitting, metal plate work, motor-car engineering, structural engineering and heating and ventilating engineering.

The granting of Degrees in Engineering by the University of London in 1903 has done much to encourage day students.

Some idea of the great number of day students may be gathered from the statistics for London alone, given by the Board of Education in a Report on the Provision of Engineering Education (March, 1927) in London.

" The number of full-time students in the four University Schools in recent years is approximately as follows :

Imperial College of Science and Technology	420
King's College	125
University College	110
East London College	50

The great majority of these students have matriculated and are preparing for London University Degrees in Engineering."

In addition there are three Polytechnics which have about 300 full-time day students in Engineering, of whom about 100 in two Polytechnics are Matriculated Engineering Degree students.

There are also the Day Engineering Departments of the University Colleges and Technical Colleges in Sheffield, Nottingham, Birmingham, Loughborough, Leeds, Manchester, Bradford, Huddersfield, Bristol, Brighton and other parts of the country, which provide day courses for Degrees and Diplomas.

In the Junior Technical Schools for Engineering in the country some 2,000 full-time day students are preparing for entry into the engineering and metal trades. These students receive a sound technical training combined with general education for two or three years and leave at the age of 16 plus. Many afterwards attend evening classes and work for the National Certificates in Engineering, and become intelligent craftsmen able to rise to good positions as workmen, foremen and managers of works.

With the introduction of the National Certificate Schemes for Mechanical Engineering and Electrical Engineering, to be described presently, the *Examinations* in *Mechanical Engineering*, conducted by the *City and Guilds of London Institute*, have undergone a change. The Institute now holds examinations in the subjects shown in the following Table, which includes the results for 1931:

	Number of Candidates	Passes
Engineering Trades	105	41
Machine Design	147	40
Structural Engineering	53	22
Motor-Car Engineering	137	63
Metal Plate Work	79	63
Boiler-makers' Work	26	16
Heating and Ventilating Engineering	38	27
Mechanical Engineers' Estimates and Specifications	32	28
Electrical Engineering Practice	588	327
Electrical Installation Work	255	152
Gas Works and Supply Practice	147	67
Gas Fitting	1,111	817

MONEY PRIZES

The following Money Prizes are given on the results of the examinations.

Armourer and Brasiers' Company Prize

In Engineering Trades (Div. II):
Final Examination

1st Prize £3 and 2nd Prize £2 10*s*.

Institution of Heating and Ventilating Engineers' Prizes

In Heating and Ventilating Engineering:

1st Prize £3, 2nd Prize £2 10*s.* and 3rd Prize £2 in the Final and in the Intermediate Examinations.

The Society of British Gas Industries

Prizes of £5 5*s.* and £2 2*s.* respectively to the first and second candidates in the Final examination in each of the following subjects: Gas Works Practice, Gas Supply Practice, and Gas Fitting.

Pewterers' Company Prizes

In Metal Plate Work:

Prizes £3 Final and £2 10*s.* and £1 10*s.* respectively to first and second candidates in Grade I examination.

ADVISORY COMMITTEES

In connection with the conduct of some of the above examinations the City and Guilds of London Institute has the following Advisory Committees:

Machinists', Turners' and Fitters' Work

The Advisory Committee of the Institution of Production Engineers.

On this Committee are represented the Institution of Production Engineers, Engineering and Allied Employers' National Federation, the Board of Education, the City and Guilds Institute, the three Technical Associations of Principals, Teachers and Institutions, and co-opted members.

Electrical Installation Work

The Advisory Committee of the Electrical Contractors' Association in conjunction with the City and Guilds of London Institute.

This Committee is composed of representatives of the Electrical Contractors' Association, Institution of Electrical

Engineers Electrical Trades Union, Board of Education, City Guilds Institute, the three Associations of Technical Institutions, Principals and Teachers, County Councils' Associations and Association of Education Committees.

Heating and Ventilating Engineering

The Advisory Committee of the Heating and Domestic Engineers' Industrial Council.

On this Committee are Representatives of the Employers' and Operatives' sides of the National Industrial Council, Board of Education, City Guilds Institute and the three Associations of Technical Institutions, Principals and Teachers.

Gas Works Practice, Gas Supply Practice, and Gas Fitting

The Gas Education Committee of the Institution of Gas Engineers.

Foundry Practice

The Advisory Committee of the Institute of British Foundrymen.

On this Committee are Representatives of the British Institute of Foundrymen, the Institution of Mechanical Engineers, Engineering and Allied Employers' Association, British Cast Iron Research Association, Worshipful Company of Founders, United Pattern Makers' Association, National Light Castings, Board of Education, Scottish Education Department, City Guilds Institute, Association of Education Committees, Union of Lancashire and Cheshire Institutes, and the three Associations of Technical Institutions, Principals and Teachers.

NATIONAL CERTIFICATE AND DIPLOMA SCHEMES FOR MECHANICAL ENGINEERING AND ELECTRICAL ENGINEERING

In Appendix II will be found a copy of part of a leaflet issued by the Institution of Mechanical Engineers, giving particulars of the National Certificates and Diplomas in Mechanical Engineering awarded by the Institution in conjunction with the Board of Education to students who pass with success through approved grouped courses of instruction at certain Technical Colleges and Schools in England. A similar scheme is in operation for Electrical Engineering, conducted by the Institution of Electrical Engineers in conjunction with the Board of Education. These schemes have been in existence about ten years and there has been a progressive increase year by year in the number of candidates.

These National Certificate Examinations are becoming an important feature in technical education, and as will be seen from the particulars in the Appendix, successful candidates are granted certain exemptions from the Studentship and Associate Membership examination of the Institution. This is a great incentive to the ambitious student, apart from the official recognition of a Professional Body and the Board of Education which confers a status on young working engineers who attend part-time day and evening classes and enables them to obtain certificates that are being recognized to an increasing extent by employers of labour.

The following extract from a Speech by H.R.H. the Duke of York at the Annual Dinner of the Institution on Thursday, 15th December, 1927, is of interest in this connection:

> " I cannot end without paying a warm tribute to the work of the Institution in respect of the educational welfare of the young engineer. The schemes carried out in conjunction with Government Departments and the issue of National Certificates and Diplomas in Mechanical Engineering to successful students, have given opportunities to the

ordinary working apprentice to obtain the knowledge necessary, not only for intelligent work as an artisan, but also to rise to a position of responsibility in his profession and to take his place alongside those who have had the advantage of public-school and university education. In extending your efforts in this direction you are rendering a national and Imperial service and are worthy of the highest praise."

Results of Examination

Mechanical Engineering

	1929	1930	1931
Ordinary Certificates . . .	787	786	974
Higher Certificates . . .	287	302	327
Supplementary endorsement of Higher Certificates . .		117	124
Ordinary Diplomas . . .	16	39	40
Higher Diplomas . . .	22	26	37

Electrical Engineering

	1929	1930	1931
Ordinary Certificates . . .	433	510	592
Higher Certificates . . .	205	227	279
Supplementary endorsement of Higher Certificates . .	4	3	8
Ordinary Diplomas . . .	10	20	8
Higher Diplomas . . .	4	4	3

A few observations are made on some of the subjects considered in a *Report of the Committee on Education for the Engineering Industry* appointed by the President of the Board of Education (the Right Hon. Lord Eustace Percy, M.P.) on the 31st October, 1928, published by His Majesty's Stationery Office (1931).

The Report is valuable as it deals with many problems of technical education in relation to engineering. Special emphasis is laid on the value of Junior Technical Schools for Engineering.

The question whether Secondary Schools should develop " engineering sides " is discussed and it is pointed out that there is no definite evidence of a demand on the part of the Industry for such " sides," or indeed for any specialized vocational training for boys in such schools before the age of 16. The opinion of the Author is that better results would be obtained by the transfer of boys at 16 years of age to Technical Institutes and Technical Colleges, which are specially staffed and equipped for giving instruction to engineering students. In most of these Senior Technical Courses, similar to those originally planned at the Finsbury Technical College, are arranged as full-time day classes, extending over a period of two years.

Attention is called to the tendency for pupils from the Secondary Schools to prefer " black-coated " occupations or if they enter the engineering industry to choose the office side rather than the workshop, and for the bulk of University Engineering students to be engaged in research, testing, design and salesmanship, rather than in productive engineering and its management. One reason given for this tendency is that some employers are too much inclined to select for promotion those engaged in the office rather than those engaged in the shops, probably because they are better known to them personally.

On the broad question of promotion the Committee says: " We are convinced that engineering should be 'a career open to all the talents' and that every boy entering the Industry should have the chance of rising to the higher positions."

Approval of the National Certificate Scheme for engineering is general and of the value of part-time Junior and Senior day courses. The subject of Trade Courses of instruction for young workers definitely related to the trades in which they are engaged is considered and suggestions made. The trades mentioned are machinists, moulders, pattern-makers, metal plate workers, boiler-makers and coppersmiths. Under the title of " Metal Plate Work " something is said about the instruction provided for the workers in the last three trades.

Many other matters and problems in technical education, which are pertinent and common to other industries as well as to engineering, with comments by educational bodies, are set out in this suggestive Report.

X

METAL PLATE WORK

The educational requirements of sheet metal workers were not so well understood in this country, before about 1867, as those of men engaged in the engineering and building trades, whose needs had been provided for earlier by books written by Engineers and Architects and by the semi-technical work of the old Science and Art Department. It was not until 1867 that any attention was paid to the technical education of men engaged in the working of sheet metal which include coppersmiths, tin and iron plate workers, zinc workers, gasmeter makers, boiler makers and plate workers in shipbuilding.

The first attempt in the direction of the education of metal plate workers was made by the late Reuben Warn, assisted by Hodgson Pratt, and by several of the leading men in the trade who arranged a private class at the St. James's and Soho Working Men's Club, Soho, London, and by an elaborate Book on Designs and Patterns for sheet metal workers published in Darmstadt at 7*s*., which Hodgson Pratt purchased for the purpose. A book called the *Sheet Metal Worker's Instructor*, by R. H. Warn, which was published by subscription in 1869, the first English book on the subject at all worthy the name, was the outcome of the efforts referred to and was a step in the right direction. From about 1870 till 1877 no further move was made with the exception of a private class which a Mr. Latter, a zinc worker, afterwards foreman at Messrs. Brabys', Euston Road, held at his house for the benefit of his fellow-workmen. With the year 1877, however, came a fresh departure. In that year there was started at the late Artisans' Institute, Castle Street, St. Martin's Lane, a class conducted by the Author, the first class of its kind ever held in an educational institution, which was transferred in 1881 to rooms in Cowper Street Schools, pending the erection of the Finsbury Technical College. Until 1879 the instruction was limited to the setting out of patterns; to that was afterwards added the physical and chemical properties of metals in relation to their behaviour when hollowed, raised and planished, the action of acids and the effect of temperature upon them, composition of solders, etc. In 1880 the City and Guilds of London Institute held an examination for Tinplate and Zinc Work in conjunction with Plumbers' Work, and in 1882 the examination in Tinplate and Zinc Work was separated from that of Plumbers' Work and extended to Metal Plate Work generally. This official recognition of the educational requirements of sheet metal workers gave the subject importance and stimulated sheet metal workers in London and later from various parts of the country to sit for examination, all of which has been very beneficial to the sheet metal trade. When the Regent Street Polytechnic was opened in 1882 a class was held there. These classes received the support of J. Deans (Secretary Amalgamated Society of Tin and Ironplate Workers), A. Harrington (Secretary Zinc Workers' Society), F. Harris (Gas Meter Makers' Association), and the Committees of these Societies. G. Harding & Sons, Southwark, F. Braby & Co., and other leading firms encouraged their apprentices and young men to attend the classes.

The two books referred to, though very useful at the time they were published, were not suitable for large work or special cases. In 1885 the Author exhibited at the International Inventions Exhibition held in London, Models and Diagrams, showing the application of geometry to a systematic setting-out of patterns for metal plate work. For this exhibit a Gold Medal was awarded, the only Gold Medal given in that class. The exhibit was purchased for the Science collection in the South Kensington Museum and created a good deal of interest amongst the trades concerned. In the summer of 1885 the Author was invited by the Birmingham and Midland Institute and the members of the trade society to deliver a course of six lectures in Birmingham on the setting-out [illegible] patterns, and in 1887 he was asked to give three lectures on Metal Plate Work in Dublin, these being the first of a series of lectures to workmen in the new Dublin Technical Schools, and classes were subsequently opened there and in Birmingham. On returning from Birmingham the Author wrote a series of articles on his system for the *Ironmonger*, and in June, 1887, published his book on *Metal Plate Work, its Patterns and their Geometry*. This book has become a Standard Work in this country and America and is used not only by Sheet Metal Workers but by Engineering Students, the fourth edition having been reprinted ten times and a fifth enlarged edition being issued in 1926.

This is mentioned to show the interest in the subject, due not only to the spread of education but to the increased use of sheet metal for ventilation, motor-cars, shipbuilding and a variety of other purposes, which has made the applications of geometry to the trade an important and essential subject. Whereas in 1873, Mr.

Latter stated that in most firms it would be difficult to find a man who could draw a pattern geometrically, it would now be rather the exception to find many men who could not do so.

In 1899 the Author was invited by the members of the Scottish Tinplate and Sheet Metal Plate Workers' Trade Society to give a lecture to inaugurate a class for metal plate workers at the Glasgow and West of Scotland Technical College on September 26th. In connection with this lecture it is interesting to remember that, when wanting apparatus for his lectures in 1799, Dr. Birkbeck visited a tinman's shop in Glasgow and found the workmen so eager to learn that he invited them to his lectures, and thus originated the movement for Mechanics' Institutions. Though these lectures were of great general interest to these men, they were not definitely suited to the trade requirements of metal plate workers whose needs were not then understood and it was 100 years later before a class was opened in Glasgow which provided the necessary technical instruction.

TECHNICAL COLLEGE, FINSBURY

(see p. 14)

SESSION 1882–3

The following Special Courses of Evening Lessons, covering a period of Two Years, have been arranged for Apprentices, Journeymen and Foremen engaged in any of the branches of

METAL PLATE WORK

This course of lessons will be found useful to Tin, Iron, and Zinc Workers, Boiler Makers and Copper Smiths, and to candidates in "Metal Plate Work" at the Technological Examinations.

First Year's Course

1. Technical Drawing and Pattern Cutting.—Sections; Elbows; construction of patterns for round, oval, oblong and other tapering articles; Oval Canister Top. Tea-bottle Top, etc. Drawing to Scale. Problems in Plane Geometry, useful to Metal Plate Workers; introduction to Solid Geometry, and its application to pattern-cutting.
2. Solders and Soldering.—Elementary instruction in Solders and Soldering; composition and use of various solders; theory and practice of soldering, brazing, etc., etc.
3. Freehand and Model Drawing.
4. Practical Geometry, Elementary Course.
5. Practical Mathematics, Elementary Course.

Second Year's Course

1. Technical Drawing.—Oval, oblong and equal-end patterns of unequal taper; T elbows, etc.; Vase and Bath patterns; Conic Sections, their development and application to various patterns, as Cowls, Lip and Spout patterns, etc.; Cone penetrated by a cylinder at right angles and obliquely to axis, etc.
2. Drawing, as Applied in the Trade.
3. Instruction in the Physical Properties of Iron, Galvanized Iron, and Tin-plate, and in Tinning Processes.
4. Chemistry, Inorganic.
5. Practical Geometry, Advanced Class.
6. Metals, Laboratory Work.—Properties and Treatment of the Principal Metals; Preparation of Alloys; Tinning Processes, etc.

Students may attend any one or more of the above classes, but they are strongly recommended to attend the complete course of instruction for each year as indicated.

Apprentices admitted at half the ordinary fees.

XI

CARRIAGE BUILDING AND WHEELWRIGHTS' WORK

Carriage building was one of the five subjects in which the Society of Arts conducted Technological Examinations in 1873. Mr. G. N. Hooper, carriage builder, of Victoria Street, London, was the Examiner in this subject until 1879, and offered Prizes of £3 and £2 respectively for the second and third best candidates (the First Prize of £5 being given by the Society of Arts) in the elementary grade. Mr. Hooper, who gave evidence before the Royal Commissioners on Technical Education in 1882, was an enthusiast for technical education, not only for his own but for other trades, and was intimately associated with Mr. G. A. Thrupp, London, and Mr. J. Philipson, carriage builder, Newcastle-on-Tyne, in starting classes for carriage builders and in founding the Institute of British Carriage Manufacturers in London in 1881. This Institute did much to foster technical education amongst its members and their workmen.

Evening classes in carriage building were held in London, first at St. Mark's College, Chelsea, then at Regent Street Polytechnic 1883, United Westminster Schools, the Westminster Technical Institute (for a short time) and at the St. Martin's School of Art, Castle Street, W.C. Classes in Carriage Building were held in the Durham College of Science, and Mr. Hooper in an address to the teachers and students there on September

27th, 1895 (Mr. J. Philipson, J.P., presiding), said: " One of your most active and respected fellow-citizens has paid me the compliment of asking me to distribute the prizes this evening in this great and busy capital of northern England, the University of which was the first to offer a home and an honourable place in its curriculum to technical teaching for carriage building, while Newcastle was the first city to give our technical teaching a more honourable position than any other city in the world—Paris not excepted." Mr. Hooper was a firm believer in the value of the work done for carriage building in the Paris schools and said so in his evidence before the Royal Commissioners on Technical Education in 1883.

By 1901 there were also classes at the Technical School, Bath; Merchant Venturers' Technical College, Bristol; Leighton Buzzard; Liverpool School of Science and Technology; Manchester Technical School; Technical School, Wolverhampton; Heriot-Watt College, Edinburgh, and the Robert Gordon College, Aberdeen.

A few of these classes are still in existence, and owing to the changes in carriage building and the growth of the motor-car industry have slightly increased in number and changed in districts. Classes in motor-car body work are held at the Liverpool Technical College, Loughborough Technical College, Regent Street Polytechnic, Wolverhampton and Stafford Technical College, Birmingham Technical College, Coventry Municipal Technical College, Manchester College of Technology, and Northampton Technical College.

The Institute of British Carriage Manufactures, now called the Institute of British Carriage and Automobile Manufactures, was instrumental in 1899 in starting, with the aid of the London County Council, a well-equipped Day School for carriage building at the Regent Street Polytechnic. The school has been considerably developed and has been removed to the Great Portland Street Annexe. The Institute is closely associated with the Coachbuilding School of the Polytechnic and is proud of its connection with the school. A "Hooper Scholarship" is awarded, the holder of which receives free tuition at the Polytechnic School, an annual grant of £20, and the Silver Medal of the Institute.

The Institute of British Carriage and Automobile Manufacturers has been carrying out one of the main objects of its Founders by promoting the advancement of technical education, especially during the transitional period of the change from the horse-drawn carriage to the motor-car. The Institute, with financial support which it receives from the Society of Motor Manufacturers and Traders Ltd. and the Worshipful Company of Coachmakers and Coach Harness Makers of London, holds Annual Drawing and Handicraft Competitions which, it is said, are the means of discovering and encouraging talent for the factory and workshops of the British motor body-building industry.

In connection with the Examinations held by the City and Guilds of London Institute there is an Advisory Committee for both Motor-car Body Work and Commercial Body Work under the title of Vehicle Building Trade, on which are representatives of the Institute of Carriage and Automobile Manufacturers, the National Federation of Vehicle Trades, the Scottish National Vehicle Builders' Association, the Master Carriage Builders' Association of Hampshire, the National Union of Vehicle Builders, Amalgamated Society of

Wood-cutting Machinists, the Board of Education, the Association of Technical Institutions and Technical Teachers' Association.

At the City Guilds Institute Examination in 1931, in the Final and Intermediate grades, 69 candidates sat of whom 42 were successful. On the results of these examinations the Coachmakers and Coach Harness Makers' Company offer £3 for a First Prize and £2 for Second Prize in the Final examination, and £2 10*s*., £2 and £1 respectively for First, Second and Third Prizes in the Intermediate examination.

WHEELWRIGHTS' WORK

Now Commercial Motor Body Building and Wheelwrights' work

The first class in Wheelwrights' Work and Van Building was opened in the Trades Training School, Great Titchfield Street, London, in 1893 under the auspices of and with the support of the Worshipful Company of Wheelwrights. Another class was opened in 1896 at the Borough Polytechnic Institute which is situated near the centre of a district where a considerable amount of wheelwrights' work and van building is done. Both classes conducted by F. W. Robson. A change has come about in the work of the wheelwright and van builder through the introduction of commercial motor vans and lorries, and his work covers all commercial vehicles whether the motive power is the horse or motor. Classes are now held at Borough Polytechnic Institute, The Polytechnic, Regent Street, W.1, The Medway Technical College, Rochester; Liverpool

Municipal Central Technical School, Manchester College of Technology, Harris Institute, Preston ; Wigan Mining and Technical College.

The City and Guilds of London Institute held its first examination in this subject in 1900, and the Wheelwrights' Company offered Prizes of £2 for the best candidate in the Final, and £1 for best candidate in the Intermediate Examination, which they still give. At the 1931 Examination 32 candidates sat, of whom 28 passed the Intermediate and Final grades.

XII

BREADMAKING AND FLOUR CONFECTIONERY

The technical education movement for bakers and confectioners is an interesting one, not only from the point of view of its value to a food industry but because of the concern of the trade for the better training of those engaged in it, and for its belief in technical education as a solution for many of their problems. The movement is a notable example of the financial and active personal co-operation with educational authorities of a trade organization, believed to be the first and best of its kind in this country. This trade organization is the National Association of Master Bakers and Confectioners—an Association which was inaugurated on February 23rd, 1887, at a meeting of ninety members of the trade in Birmingham, presided over by Councillor T. Fletcher, a Birmingham master baker. After routine business had been transacted, two days were spent in reading and discussing no fewer than eight papers, four of which had been prepared by allied traders and four by bakery members. The titles of the papers are of interest as showing the beginning of a movement for the betterment of the Trade, viz.: Some Experiences in Flour Blending; Appliances for the Production of Bread; Breadmaking Machinery — An Historical Sketch; Systematic Examination of Yeast and Flour; Valuation of Flour; Roller Process Milling; Leaven: What it is, its origin; and last, but not least, Training for Bakers and Confectioners. Here it may be pointed out that the City and Guilds of London Institute had held its first examination in Breadmaking in 1882. Professor Charles Graham, D.Sc., who delivered the Cantor Lectures, on "The Chemistry of Breadmaking," at the Society of Arts in 1880, was the Examiner. At the first annual meeting of the National Association of Master Bakers in March, 1888, a letter was read from Sir Philip Magnus, of the City and Guilds of London Institute, requesting "the assistance and co-operation of the National Association in promoting technical education in the science and art of breadmaking."

Subsequently a deputation waited upon the Committee of the Institute, and this was the beginning of the present-day co-operation between the two bodies.

A step forward in Trade Education was taken during 1889 by the offer of prizes in three competitions:—(1) An Essay on Breadmaking, (2) An Examination in Breadmaking, and (3) An Examination for Journeymen only. Cantor Lectures at the Society of Arts, in 1900, on Modern Development of Breadmaking were delivered by Wm. Jago, F.I.C.

During the year 1890, W. A. Thomas, of Alyth, N.B., made suggestions for a technical and practical training Institute for bakers, the best locality for the Institute being London. A paper was also read by John Kirkland on a Training College. The idea of a Bakers' Institute or College was reintroduced by T. Fletcher and G. Cox at several annual meetings, 1890, 1902 and later, but for financial and other reasons nothing was done. The opportunity, however, came in a modified form when the National School of Bakery and Confectionery was established in 1898 at the Borough Polytechnic Institute, an account of which we proceed to give.

This School began in a small way. Sir Philip Magnus and the Author went, in 1894, to see John Blandy at his shop in Uxbridge Road, where, in connection with his business, he, as an enthusiast for education for the trade, was teaching a few young bakers; and persuaded him to come to conduct a class at the Borough Polytechnic Institute. A class for evening students was inaugurated there by a meeting on October 10th, 1894, presided over by W. Kurtz (President London Master Bakers' Protection Society), and attended by over 130 master and journeymen bakers. The one class started then had increased to five classes in 1898. There was an average attendance of sixty-six, notwithstanding that it was carried on under great difficulties, by reason of the absence of proper accommodation for practical work.

The year 1898 was the most important one in the history of technical education for bakers and confectioners. In that year a building extension was opened at the Borough Polytechnic, and in it one of the largest rooms had been fitted up as a model bakery at a cost of over £700, defrayed by a grant from the Technical Education Board of the London County Council. A special meeting presided over by A. L. Johnston, a member of the Council and afterwards President of the National Association of Master Bakers, was held on October 10th for the purpose of creating a greater interest in technical education for bakers, and so justifying the expenditure incurred.

Sir Philip Magnus sent a letter on November 21st, 1898, to A. W. Last, Secretary of the National Association, calling attention to the examinations then held by that body, which overlapped with the examinations of the City and Guilds of London Institute, and asking in what way the examinations of the Institute might be improved or developed with a view to the requirements of the industry. As a consequence of this letter negotiations ensued between the City and Guilds of London Institute and the National Association of Master Bakers, the object of which was to ascertain how far the examinations that had been carried on by the Association could be merged into those conducted by the Institute, this being regarded as important to the development of the educational work of the trade throughout the country. As a result, there is now complete co-operation between the two bodies in regard to breadmaking and confectionery examinations.

On December 7th, 1898, John Blandy and the Author attended a meeting of the Central Board of the London Master Bakers' Protection Society and appealed for assistance for the School. At this meeting a grant of £50 a year was considered, and approved at the next meeting.

In November, 1898, the Council of the National Association of Master Bakers and Confectioners had their attention directed, by an open letter in the trade Press from J. Blandy, to the general bodies interested in the education of the baker.

On November 28th, 1898, S. B. Leicester (President of the National Association of Master Bakers and Confectioners) and T. Fletcher (Past President) visited the Borough Polytechnic Institute, and had an unofficial conference with the Author over the best ways in which the Borough Polytechnic and the National Association could co-operate for the benefit of technical education for the bakery and confectionery trades. A Council meeting of the National Association was held at the Borough Polytechnic on December 8th, at which a scheme was outlined whereby the Association was to consider a grant of £300 a year to the Polytechnic. One remark made by the President at this meeting is worth repeating, because it shows that the pioneers were right. The President said: "It is the belief of Mr. Fletcher, Mr. Morrison, and myself that such a scheme would eventually lead to practical bakery schools like that at the Borough Polytechnic being established, for the benefit of the trade, in the large towns of the provinces." It will be seen that this has come about in a remarkable degree.

The outcome of these negotiations was an agreement between the Governors of the Borough Polytechnic Institute and the Association, the principal articles of which are as follows:

(1) The National Association of Master Bakers and Confectioners shall contribute a sum of not less than £300 a year in cash to the Borough Polytechnic Institute, to supplement the funds contributed and obtained by the authorities of the Institute towards the maintenance of the bakery and its classes, held in connection with the Institute.

(2) The bakery shall be called the "National School of Bakery and Confectionery, Borough Polytechnic Institute."

(3) There shall be an Advisory Committee to make regulations, subject to the general approval of the governing body of the Institute, with respect to the management of the school. The Advisory Committee shall consist of representatives nominated by the National Association of Master Bakers and Confectioners, and of representa-

tives appointed in accordance with paragraph 5 below. The Chairman of the governing body of the Borough Polytechnic Institute and its Principal shall be ex-officio members.

(4) The National Association of Master Bakers and Confectioners shall have power to appoint one of their members on the governing body of the Institute.

(5) For every £25 contributed by a trade organization or private individual for maintenance and scholarships, such trade organization or private individual shall have the power to nominate a representative on the Advisory Committee.

(6) The standing orders and fundamental principles of the Charity Commission's scheme, and also certain broad principles laid down by the Technical Education Board (London) under which the Polytechnic Institute is managed, to be recognized by the Committee.

The Advisory Committee referred to in the Articles was formed in May, 1899, and Councillor T. Fletcher, of Birmingham, who as previously stated had taken great interest in educational and other matters connected with the bakery trade, was appointed by the Association as its representative on the governing body of the Borough Polytechnic Institute. Councillor T. Fletcher was also elected chairman of the Advisory Committee.

Later a sub-committee on education was appointed by the National Association, which, with additional members from the Polytechnic, became the Advisory Committee of the School, and later the Education Committee of the National Association. This Committee also acted as an Advisory Committee to the City and Guilds of London Institute for examination purposes.

The inaugural meeting of the School was held on

September 21st, 1899, under the presidency of Councillor T. Fletcher, who was supported by Edric Bayley, L.C.C. (Chairman, Borough Polytechnic), T. A. Organ, L.C.C., and Dr. Garnett on behalf of the London Technical Education Board, by G. Winn, President of the National Association of Master Bakers and Confectioners, and others. The Chairman, in his opening remarks, said that he believed that the starting of the School would mark a new era of development and progress in their trade, and that the helpful influence of the classes would not be confined to those who were able to attend them, but would spread wider and wider until it was felt throughout the whole industry. They would be certain to see higher standards of excellence reached and higher ideals raised up for general attainment. He believed, for one thing, that in the manufacture of bread, the influence would help to sweep away the rule-of-thumb methods prevalent in the past. He thought the School would exercise such an influence that, very soon, people would not be able to assert that the average English confectioner was not as efficient as many continental confectioners. They knew that the making of choice confectionery was an art, and the making of good bread a science, and the object of the teachers of the School would be to make every student as efficient as possible.

Considerable interest in the work of the School was taken by educationists about this time. In 1901 the Author was invited to write an article on the School for *The Record of Technical and Secondary Education*, and an article, in 1902, for the Department of Agriculture and Technical Instruction for Ireland on technical education for bakers and confectioners.

In 1902 a further building extension, at a cost of over

£3,000, was carried out at the Polytechnic to provide additional accommodation for the bakery school. Towards the cost of building the London County Council gave £1,952, and the National Association £460. Messrs. Werner, Pfleider and Co. very generously supplied the equipment at a cost of £1,250. The foundation-stone of the new building was laid by Councillor T. Fletcher on February 5th, and on September 9th the buildings were formally opened by Alderman F. Tonsley, J.P. (President National Association Master Bakers), who, in the course of his speech, said that young men had now the opportunity of equipping themselves in everything appertaining to their trade. He hoped that the result would be that the baking trade would be one that would be looked up to in the future, and be up to the standard of other trades.

There is no doubt about the standard of the educational work of the baking trade having risen to the equal of that of other trades.

When the building operations were completed, the School was in a position to carry out the wish of the founders, i.e., that it should become a central school for the country, in which promising students might be educated to become in their turn teachers in the smaller schools which would probably be established throughout the country.

It can safely be said that already the work of the National School has done much to raise the standard of both breadmaking and confectionery amongst workers in this country, not only by the work done in the School, but by the instruction which it has been able to give in local centres to supplement the instruction there given; thus, a course of lectures on breadmaking was delivered at Leicester, and on confectionery in Birmingham and in the Midlands. In consequence of the arrangements made by the Scottish Association of Master Bakers, lectures and demonstrations at the expense of that Association were also given in Scotland at several centres during two months of the session. The School has been the means of training the Head Teachers of the Bakery Schools of Birmingham and Leeds.

The National School in London was followed by a school on the same model at the Glasgow and West of Scotland Technical College. Next in order come the Bakery Schools at the Manchester College of Technology, Cardiff Technical College, Leeds Technical College and the Municipal Technical Institute at Birmingham. All these Institutions have full-time day courses extending over two years. There are no Junior Technical Schools for the bakery trade at present. The National Association of Master Bakers award a Diploma to students who have pursued successfully such a two-years' full-time course of education in breadmaking and confectionery at an approved school or college. In England alone there are bakery classes in twenty-seven towns, five of which have full-time courses and the remainder part-time courses. The number of individual students in attendance at the schools in December, 1930, was 1,837.

There is a Scholarship Fund, made up by the trade and allied traders, amounting to £1,523 for 1931, and £1,518 has already been awarded to students attending the schools. The Worshipful Company of Bakers gives £150 to the Scholarship Fund, and £50 to the National School for Exhibitions for day and evening students. In addition the Company gives a First Prize of £3 3*s*., and a Second Prize of £2 2*s*. on the results of the City and

Guilds of London Institute's Final examination, and offers the privilege of the Freedom of the Company to the First Prize winner, at a nominal fee of £2 2*s*. This Company has from the first days of the School assisted by lending its hall on many occasions for students' meetings, and has also within its limited means given generous financial help.

The first full-time teachers of the School were C. Norwak for the Confectionery Section in 1899, and G. H. Vass for the Bread Section in 1900. On the retirement of G. H. Vass in 1902, John Kirkland was appointed Teacher of Breadmaking and Head of the School. H. W. Lee succeeded C. Norwak in 1903. He retired in 1919 to become a Master Baker and is the 1932 President-elect of the National Association of Master Bakers and Confectioners. R. A. Wright, B.Sc., an old student of the School and now the Head of the Birmingham Bakery School, was appointed successor to H. W. Lee.

The students of the National Bakery School, with encouragement from its Head, started a Students' Society, and as many of the students lived out of London the movement grew and Bakery Students' Societies have been formed in the Bakery Schools in Manchester, Liverpool, Grimsby, Leeds, Bradford, Huddersfield, Halifax, Leicester, Birmingham, Coventry, Loughborough, Derby, Nottingham, Swansea, Cardiff, Bristol and Sussex. A National Federation of Bakery Students' Societies had been formed, conferences are held, and a Bakery Students' Magazine, edited by R. A. Wright, B.Sc., is published monthly by the National Association of Master Bakers.

Conferences of Members of the National Association Education Committee, Teachers and Principals of Institutes where there are Bakery classes, are held to consider methods of teaching, syllabuses of instruction and examinations. Such conferences have been held at the Borough Polytechnic, at Queens' College, Cambridge (1929) and at Buxton (1931).

The following figures may be of interest as showing progress made. In the first examination in Breadmaking, held in 1882 by the City and Guilds of London Institute, there were 41 candidates, and of these only 1 candidate, John Steele, who sat at Glasgow, passed 1st Class in Honours, awarded First Prize £5 and Silver Medal. In 1885, 10 candidates sat, and in 1886 the number of candidates was increased to 20, of whom 9 passed. In 1931 the number of candidates for Breadmaking was 195, of whom 85 passed the Intermediate and 34 the Final examination. In Flour Confectionery there were 261 candidates, of whom 160 passed the Intermediate and 55 the Final examination.

As regards Text-books and Trade Literature, the only works of reference mentioned in the City and Guilds Institute Programme of Examination for 1885 were: *Handbook of Chemistry*, Roscoe and Schorlemmer; *Dictionary of Chemistry*, Muspratt; *The Miller*, for articles on Milling and Breadmaking since 1870; and Lectures on the *Chemistry of Breadmaking* (Society of Arts, 1880) by Professor C. Graham, whereas now there is an abundant supply of Text-books and books of reference a list of which would be too long to give here. There are also the Trade Journals such as the *National Association Review*, the Official Journal of the National Association of Master Bakers; *The British Baker*: and the *Baker and Confectioner*.

XIII

LEATHER TANNING AND DYEING

The provision of technical education for those engaged in the leather trade industries is a very good illustration of the value of the interest taken by leading men in education for their industry, of the co-operation of trade organizations, and also of the generosity of two City Companies of London, the Leathersellers' and the Skinners' Companies.

The subject of Leather Tanning, as it was then called, was introduced into the Progamme of Examinations by the City and Guilds of London Institute in 1880 and the first Examiner was J. G. Hepburn, LL.B., F.C.S. In 1882 there were only four candidates. They had been prepared by private study or tuition and all passed.

Technical Schools and Laboratories for the education of those engaged in the leather trade had been in existence on the Continent for many years. Two such laboratories may be mentioned; that of Vienna, which was the first of the kind, and that of Freiberg, in Saxony. In this country there was no similar school until 1884, when the first serious attempt in the direction of the application of science to this old-time industry was made by Professor H. Richardson Procter, F.R.S., D.Sc.—a practical tanner who had a scientific bent and was appointed to a Lectureship at the Yorkshire College, Leeds. There are now two Institutions devoted to the technology of the leather industry, one at Leeds, which is intended to give instruction in the higher sciences and confers collegiate degrees ; the other, the Leathersellers' Technical College, London, designed to train works managers, foremen, and to fill the void created by the abolition of apprenticeship in the trades. Both these Institutions, working in co-operation though in different fields, have the same object in view.

Since their establishment considerable progress has been made in the application of science to leather manufacture. It is only during the last thirty to thirty-five years that the leather industry has emerged from the empirical and " rule-of-thumb " stage, into an industry dependent for the quality of its productions upon the exact application of scientific principles.

Under the able direction of Professor H. R. Procter, the Lectureship at Yorkshire College, Leeds, developed into the Leather Industries Department founded in 1891 at Leeds University, and he was appointed first Head of the Department. This was built and equipped by the Worshipful Company of Skinners at a cost of £5,600. The Company contributed £500 a year for many years and at the present time gives £250 annually. The Department soon became the chief institution in the world for training in the science of leather manufacture.

Professor Procter, F.R.S., D.Sc., whose original contributions were numerous and valuable, may be regarded as the pioneer of the scientific advancement of the industry, and his attainments later obtained international recognition. His world-wide reputation was demonstrated by the erection of the Procter International Research Laboratory by members of the trade throughout the world in appreciation of his unique services ; and the decision of the International Society of Leather Trades' Chemists to found a Procter Research Fellowship in

Leeds University to perpetuate his name and ideals is further evidence of the esteem in which he was held.

The First Conference of the International Society of Leather Trades' Chemists was held at Herold's Institute, Bermondsey, in 1897, and the Author, as Principal of the Borough Polytechnic and Herold's Institutes, had the privilege of welcoming the members and of presiding at the first part of its proceedings pending the election of the Business Chairman, Dr. W. H. Perkin, F.R.S., the celebrated chemist.

The account of the origin and development of the London School of Leather Manufacture, which owes much of its first success to Professor Procter's advice and work and to the experience gained in the Leeds School, is given in some detail because it shows how from very small beginnings it has become the largest and best-equipped school in the world.

An attempt was made in 1892, at the Borough Polytechnic Institute, to start a class of technical instruction in leather manufacture; and, two years later, in 1894, the Governors of that Institute were, at the suggestion of S. G. Lutwyche (a Warden of the Company), approached by the Worshipful Company of Leathersellers in the matter of the establishment of a Tanning School. As a result of negotiations, the Governing Body of the Borough Polytechnic Institute undertook, with financial assistance from the Leathersellers' Company, to organize for the Session 1894–5 a Course of Evening Technological Lectures in Leather Manufacture at Herold's Institute, Bermondsey, a building which was lent to the Borough Polytechnic Institute by the Governors of Herold's Foundation, the trustees of the buildings. A course of Lectures was given by S.

Lavington Evans, J.P., of Sittingbourne. The unqualified success of these Lectures encouraged further effort; but it was fully recognized that lectures alone would be insufficient to afford the requisite technical instruction, and that the need could not be effectually met otherwise than with a large and well-equipped tanning laboratory and a permanent teaching staff. Accordingly, negotiations again took place to establish a Tanning School between the Leathersellers' Company, the Governors of Herold's Foundation, and the Governing Body of the Borough Polytechnic Institute, the result being that the Company made a grant of £600 for the fitting up and one year's maintenance of a Tanning Laboratory, whilst the Governors of Herold's Foundation undertook, at a cost of £600, to make the structural alterations necessary to the building for such laboratory, and, further, to lease it to the Governors of the Borough Polytechnic Institute at a nominal rent; the last-named body undertaking the management of the School, with Colonel Bevington as Chairman, representing the Leathersellers' Company. Dr. J. Gordon Parker, who had been an assistant to Professor H. R. Procter, was appointed Director.

With a well-equipped laboratory, and buildings structurally improved, the Session 1895–6 was opened by T. Peart, Master of the Leathersellers' Company. The success of the Leather Tanning Laboratory led to plans for setting up a Leather Dyeing Laboratory and Department. With this in view the Governors of Herold's Foundation gave the use of another building opposite the Tanning Laboratory building, and agreed to spend £200 in structural alterations. The Leathersellers' Company and the Technical Education Board of the London

County Council made grants of £200 each for equipment, and £200 a year each for maintenance. Mr. Walter Towse was appointed to the charge of the new Department, and it was opened by Dr. (afterwards Sir) W. H. Perkin, F.R.S. (Master of the Leathersellers' Company), on October 29th, 1896. This opening meeting was largely attended, amongst those present being the Wardens of the Leathersellers' Company, the Master of the Curriers' Company, Edric Bayley, Chairman of the Borough Polytechnic Institute, and various members of its Governing Body, Dr. W. Garnett, Professor H. E. Armstrong, F.R.S., Professor Procter, Dr. C. W. Kimmins, Alderman (now Sir) Evan Spicer, C. T. Millis (Principal), and many other persons interested in education; Colonel S. B. Bevington, J.P., S. Barrow, J.P., John Pullman, J.P., Charles E. Parker, George Gibbs, A. Seymour Jones, J. T. Wood, George Peeke, and other prominent members of the leather trade.

The School was now provided with two Departments with laboratory accommodation, one in Leather Tanning and Leather Dressing, and the other in Leather Dyeing and Leather Staining. In 1896 day students were formally recognized, these being mostly sons of tanners, or others likely in the near future to be managers of leather works. The students at the evening classes were mainly working foremen, journeymen, and apprentices.

As the administrative work of the School gradually became more onerous and complicated, the Governors of the Borough Polytechnic Institute decided in 1897 to appoint a Herold's Institute Local Committee as follows: Colonel Bevington, Chairman, the Master and Wardens of the Leathersellers' Company, Dr. C. W. Kimmins, Alfred Lafone, M.P., Rev. J. Scott Lidgett, S. W.

Lutwyche, and C. T. Millis, the last named representing the Governors of the parent Institute. Afterwards John Pullman was added by the Leathersellers' Company.

In 1899 Mr. W. Towse accepted an appointment in a large manufacturing firm, and Mr. M. C. Lamb (the present Principal) who had previously been an Assistant to Professor Procter, and Demonstrator in Leather Industries at Yorkshire College, Leeds, was appointed to conduct the Leather Dyeing Department. Research work began in 1898 and investigations of great value to the trade have since been carried out. The resources of the Institute and the services of its staff have been made use of by the Imperial Institute, the Society of Arts (in its inquiry on Leather for Bookbinding), the London Chamber of Commerce, and other public bodies.

The need for a small experimental tannery was keenly felt and a miniature plant of twelve pits was installed and in 1900 a shed was built for certain leather-working machinery which had been presented by well-known trade engineers and others, among the donors being J. Hall & Sons, Leeds; E. Wilson, Exeter; T. Haley & Co., Leeds; and J. Meredith-Jones, and A. Seymour Jones. The Century Tanning Co., Wrexham, supplied all the belting.

The experience gained at Herold's Institute during fifteen years demonstrated that the buildings were inadequate in size and equipment for dealing satisfactorily with the increasing number of students who sought instruction; moreover, the locality of the Institute was not easy of access. The success of the Herold's Institute experiment and the general benefit it had been found to exert on the industry decided the Worshipful Company of Leathersellers to undertake the purchase of a new site and equipment of a modern and up-to-date College replete in all respects to meet any future demands which might be made upon it from all sections of the leather industries. Plans were prepared, on which the Court of the Company obtained the advice of Professor Procter and such practical men in the leather trade as Lord Allerton, Mr. (now Sir) Samuel Barrow, Junr., A. Seymour-Jones and C. E. Parker. The site in Tower Bridge Road, Bermondsey, upon which the College, known as the Leathersellers' Company's Technical College, has been erected, was formerly well known as Bacon's Tanneries. The entire cost of the building and equipment, amounting to £20,000, plus an additional £5,500 at a later date, was borne by the Company. At the opening ceremony by the Lord Mayor, Sir G. Wyatt Truscott, on the 1st of October, 1909, it was stated that the College was not only the largest of its kind in the world, but far surpassed the tanning schools of the Continent in perfection of equipment and in leather-working plant. The Company maintains a research assistantship and has subsidized many researches, e.g. in relation to anthrax.

Dr. J. G. Parker retired in 1927, and Mr. M. C. Lamb, F.C.S., was appointed Principal of the College.

The examinations in Tanning Leather in 1880, now called Leather Manufacture (Tanning and Dressing of Heavy and Light Leather), and a separate examination in Leather Dyeing and Finishing, conducted by the City and Guilds of London Institute, have been undoubtedly of great assistance in the technical education of these industries, especially with the help of the Institute's Advisory Committee on Leather Manufacture, on which there are Representatives from Leeds University, the Leathersellers' Technical College, London, the Leeds, Northampton and Runcorn Technical Colleges, United Tanners' Federation, Amalgamated Society of Leather Workers, Messrs. Walker & Sons, Bolton, the Board of Education and the City Guilds Institute.

The Dyers' Company offer a Prize of £2 in the Final grade, and £1 10*s*. for First and £1 for Second Prize in the Intermediate grade of the examination in Leather Dyeing.

In the 1931 examination in Leather Manufacture 154 candidates sat, of whom 50 passed the Final, 34 the Intermediate, and 37 the Preliminary grades, a total of 121 passes. In Leather Dyeing and Finishing there were 50 candidates, of whom 23 passed the Final and 20 the Intermediate grade.

One notable feature in the Technology of Leather Manufacture is that of its Literature. In the City Guilds Programme of Examinations in 1880 there is a list of only three (excepting one of a more or less popular character) works of reference, all by foreign writers and published in America. In the 1930 Programme there are ten works on the subject, all by English authors. Four of these books are by the late Professor Procter: *The Leather Industries Laboratory Book*, 2nd Ed., 1908 (reprinted 1919); *Principles of Leather Manufacture*, 2nd Ed., 1922; *The Leather Chemists' Pocket Book*, and the *Manufacture of Leather*; two books by Mr. M. C. Lamb on *Leather Dressing and Dyeing* and *The Manufacture of Chrome Leather*; one on *The Manufacture of Leather*, by H. G. Bennett; one on *Practical Leather Manufacture*, by H. G. Crockett; one on *Pucring, Bating, and Drenching of Skins*, by J. T. Wood; and one on *Tanning Materials*, by A. Harvey.

XIV

BOOT AND SHOE MANUFACTURE

In accordance with a suggestion made by Mr. H. D. Richardson, Editor of the *Boot and Shoe Trades Journal*, endeavours were made in the early part of 1882 to hold a meeting of workmen engaged in the boot and shoe trade in Finsbury for the formation of technical classes. Mr. Richardson gave evidence before the Royal Commissioners on Technical Education at the House of Commons on March 29th, 1882, when he pointed out the need for technical education owing to change in methods of boot and shoe manufacture. Mr. A. Hannibal (Messrs. Lilley & Skinner) held a class for boot and shoe workers at his private residence and later, in 1883, conducted a large and successful class at the Regent Street Polytechnic. At the International Health Exhibition, 1884, Mr. Hannibal exhibited Models and Diagrams illustrative of the teaching of Boot and Shoe Making.

In Leicester, Science Classes had been held in the Wyggeston Schools, but no special technical instruction had been given in connection with them, and in 1882 efforts were made to add a Technical School to these Science Classes, in which the instruction should have special reference to the Hosiery, Boot and Shoe, and Dyeing Trades. On July 31st of that year Mr. (as he then was) Philip Magnus attended a meeting in Leicester of the representatives of the Chamber of Commerce, the Governing Body of the Wyggeston Schools, and the principal manufacturers in Leicester when the question of erecting a new wing to the schools for the establishment of a Technical School was discussed. As a result of this meeting Mr. Hannibal was put in communication with the Rev. James Went, Head Master of the Wyggeston Schools, in reference to the proposed Technical School for the boot and shoe trades of that town. He submitted a syllabus of the subjects necessary to be taught in those trades, together with other useful information, and was asked if he would read a paper on the subject if invited to do so.

The Leicester Technical School, towards which the City Guilds Institute granted the sum of £700, was formally opened on November 20th, 1884, by Sir Henry Roscoe. Classes commenced work on February 3rd, when 129 students entered the class for Boot and Shoe Making under W. J. Rowlett and W. B. Burdett.

In the following year, 1885, classes for those engaged in boot and shoe manufacture were opened in Northampton.

In 1886, a committee of the Boot and Shoe Manufacturers' Association was formed in London to consider what could be done for technical education in the industry. One result of this committee's work was the founding, in 1889, of the Leather Trades School in the Bethnal Green Road, by the joint co-operation of the City and Guilds of London Institute, the Leathersellers' Company, the Cordwainers' Company, and the London Boot and Shoe Manufacturers' Association. The Clothworkers' Company and the Leathersellers' Company each gave sums of £500 to the equipment fund. In 1892 the grant from the City and Guilds of London Institute was increased from £400 to £500 a year. The Leathersellers' Company gave £210 per annum up to 1894 when, owing to the establishment of the Leathersellers' Technical College, this grant was withdrawn. The Cordwainers' Company then increased its contribution from £200 to £400 a year, and finally in 1914, when the Leather Trades School was incorporated, undertook still greater responsibility and the name of the School was changed to the Cordwainers' Technical College. The Cordwainers' Company now gives annually £500 to the College, and £250 to the City Guilds Institute, which latter sum is allocated to the College. The Skinners' Company awards Prizes to the value of £21 a year. The Curriers' Company and the Girdlers also subscribe to the funds of the College. Evening classes, Day Senior courses and a Day Junior Technical School for the boot and shoe trade are held in the College, also evening classes in Leather Goods Manufacture: (1) Fancy leather work, and (2) Solid case work.

The College is now situated in a building in St. John's Lane, Clerkenwell, formerly used as an elementary school, but now adapted by the London County Council, which body makes an annual grant of over £3,500. It is managed by a Board consisting of Representatives of the Cordwainers' Company, the London County Council, and the Boot and Shoe Manufacturers' Association. A name which should be specially mentioned in connection with the work of the College is that of the late C. Lavers Smith, a Past Master of the Cordwainers' Company, and one of its representatives on the City and Guilds of London Institute. The Chairman of the Board is H. W. Peal, J.P. (a Past Master of and the Father of the Cordwainers' Company), who has done much to secure the Company's support for the College. There are separate trade advisory committees for the Boot and Shoe Manufacture and Leather Goods Manufacture.

A step which has exerted an important influence on technical training in the boot and shoe trade of the country was the appointment of an Inspector of boot and shoe classes, for whose salary the Cordwainers' Company made a yearly contribution. The Department of Technology of the City and Guilds of London Institute came to the conclusion that the classes registered under their department were being run on very different lines and desired to help the local authorities concerned in the better conduct of their classes for other than merely manipulative work. John May, of Bristol, was appointed Cordwainers' Inspector to the Technological Department (part time), with the duty of inspecting all registered classes and reporting to the Department. Copies of the report were then sent to the local authorities, a procedure which was much appreciated by them and their teachers.

Later on reports were also made on the disjointed part-time evening classes held without any relation whatsoever with other classes, and the Inspector recommended the appointment of a full-time teacher to correlate and organize the work of all the classes in Boot and Shoe Manufacture at each institute. Leicester was the first centre to adopt the suggestion and appoint a full-time teacher. Stafford, Norwich, and Leeds followed. The work of the boot departments in all cases took on new vigour, and the present state of the work of the country owes its well-being to the idea of having a full-time chief instructor. Some centres have as many as four or five full-time instructors, and day-time instruction has been developed in at least three or four centres. The inspection of the classes has now been taken over by the Board of Education; but the Cordwainers' Inspector did much to bring about co-operation between the centres, and the National Convention of Boot and Shoe students also owes a great deal to his efforts.

Besides the schools named, there are now schools at Kettering, Wellingborough, and Rushden. In all these centres, according to the papers referred to below, much attention is being paid to the courses of instruction and problems of technical education in relation to Boot and Shoe Manufacture.

The National Institution of the Boot and Shoe Industry was Incorporated on April 1st, 1927, and among its "Objects" are the following:

(1) To promote the general advancement of knowledge in the boot and shoe industry (hereinafter called "the industry") and to foster the systematic study of problems which are of interest to the industry as a whole.

(2) To promote technical education in the industry and to encourage students to pursue their general and technical studies to the highest standard attainable.

(3) To give a national status to the more highly qualified students and to encourage original work and research dealing with any problems pertaining to the industry requiring skilled application and study.

Two interesting and instructive papers on problems connected with the technical education of an industry which has over one hundred operations in the ordinary factory were read at the Summer Meeting of the Association of Technical Institutions on June 28th and 29th, 1928. These were "Technical Education for the Boot and Shoe Industry," by F. W. Roberts (Head of the Boot and Shoe Department, Leicester Technical College); and "Organization and Technical Requirements for the Boot and Shoe Industry," by A. E. Elkington (Hon. Examiner Boot and Shoe Manufacture, Northamptonshire County Council, and late Examiner—City Guilds Institute).

In response to a request from the Leicester Technical School, the City and Guilds of London Institute added the subject of Boot and Shoe Manufacture and held its first examination in that subject in 1885, at which 69 candidates presented themselves. Nearly all these candidates had received instruction at the Technical School, Leicester, and 25 of them passed the examination out of a total of 34 successful candidates. In the following year classes were opened at Northampton; the number of candidates for examination increased to 116 and the Northampton candidates gained 43 out of a total of 60 successes. In the 1931 examination 237 candidates sat, of whom 109 passed the Intermediate and 44 the Final grade.

The Skinners' Company offers £3 and £1 10*s*. for First and Second Prizes respectively in the Final grade examination in Boot and Shoe Manufacture held by the Institute.

In connection with their examination the City Guilds Institute has an Advisory Committee on which are representatives from Norwich, Stafford, Leicester, Leeds, and the Cordwainers' Colleges; the Cordwainers' Company; the Northampton and Staffordshire Education Committees; the Board of Education; National Institution of the Boot and Shoe Industry; the Incorporated Federated Associations of Boot and Shoe Manufacturers; National Union of Boot and Shoe Operatives and the City Guilds Institute.

Technical education for Boot and Shoe Manufacture suffered in its early days from the absence of text-books for guidance, and experience had to be gained for the conduct of classes and methods of teaching. In the 1930 Programme of the City Guilds Institute the following list of books is given: *The Manufacture of Boots and Shoes*, by F. Y. Golding; *Boot and Shoe Design and Manufacture*, by E. Swaysland; *Technology of Boot and Shoe Manufacture*, by Crepidaw; *Boot and Shoe Manufacture*, by F. Pluckenett; *Boot and Shoe Costing*, by L. C. Headley; *Sewing Machinery*, by J. W. Urquhart; and three books on the Human Foot.

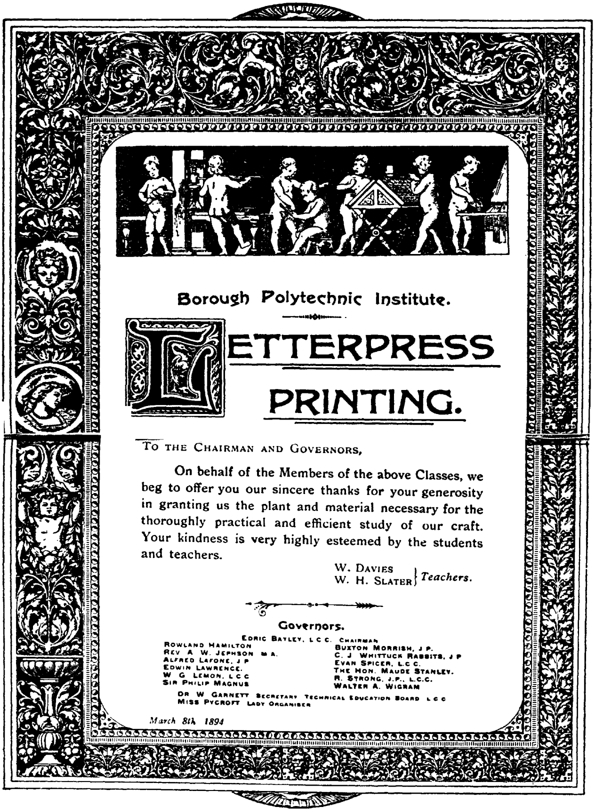
XV

PRINTING

The printing trade is another excellent example of the interest and co-operation of employers in the educating and training of their young workpeople, particularly in the Composing and Machine Printing Departments.

The City and Guilds of London Institute's Examinations in "Typography," instituted in 1880, gave the impetus to the opening of classes for Printers. The examination consisted at first of a written paper, a practical test being added in 1886. This practical test was carried out in printing works lent by Master Printers: in London, through the interest of Sir Sydney Waterlow, it was conducted at Messrs. Waterlow's Works, in Finsbury.

The first classes in London were held at the Regent Street Polytechnic in 1883, at the Aldenham Institute about 1888, the Borough Polytechnic Institute, 1892, and St. Bride's Institute, 1894. From about 1892 these printing classes had the active support of leading Master Printers such as Sir H. Bemrose, M.P., Walter Hazell, M.P., Ralph Hazell, Ernest H. Hart, G. W. Jones, and Managers of leading firms. The support consisted in presiding at meetings of students and in offering Prizes in money and kind. Owing to the interest taken in these developments by members of the Master Printers' Association, Master Printers, recognizing the value of technical education, introduced the commendable plan



Borough Polytechnic Institute.

LETTERPRESS PRINTING.

To the Chairman and Governors,

On behalf of the Members of the above Classes, we beg to offer you our sincere thanks for your generosity in granting us the plant and material necessary for the thoroughly practical and efficient study of our craft. Your kindness is very highly esteemed by the students and teachers.

W. Davies
W. H. Slater } *Teachers.*

Governors.

Edric Bayley, L.C.C. Chairman

Rowland Hamilton
Rev A. W. Jephson M.A.
Alfred Lafone, J.P.
Edwin Lawrence.
W. G. Lemon, L.C.C.
Sir Philip Magnus

Buxton Morrish, J.P.
C. J. Whittuck Rabbits, J.P.
Evan Spicer, L.C.C.
The Hon. Maude Stanley.
R. Strong, J.P., L.C.C.
Walter A. Wigram

Dr W. Garnett Secretary Technical Education Board L.C.C.
Miss Pycroft Lady Organiser

March 8th 1894

Printed at the Borough Polytechnic Institute, Borough Road, S.E.

The above Design was composed and printed by Borough Students at the close of the second Session of the Borough Printing Classes, 1893-94, and was the first piece of printed work produced by any technical school in the country.

of allowing their apprentices time without loss of wages to attend printing classes at 5.30, paying their fees and in other ways encouraging attendance. This is a good example which might well be followed in other trades.

In 1893 an important step forward was taken in the instruction given in printing classes, which hitherto had not included practical work as part of the course, when the Authorities of the Borough Polytechnic Institute, having come to the conclusion that some amount of practical work was necessary to illustrate the purely theoretical side of the teaching, as with the other trade classes of the Institute, purchased, with the aid of a special grant from the London County Council, type and a Golding Jobber Platen for that purpose. Two evenings a week were then devoted to theoretical and practical instruction, and to the Borough Polytechnic Institute credit is due as being the first Institute to introduce practical work on a systematic basis. Such instruction now forms a definite part of the course in all printing classes. To commemorate this change, a Design was composed and printed by the Borough students at the close of the 1893-4 Session of the Borough Polytechnic Printing Classes.[1] This was the first piece of printed work produced by any technical school in the country, and copies of the Design to the number of 500 were printed and circulated among the trade. From 1894 a Booklet of specimens of students' work, set up and printed entirely by the students in the Institute, was issued annually. The issuing of these Booklets has since become the work of printing classes—a notable advance on the instruction given in the early days. It is interesting to Printers to mention here that to George W. Jones, known to the trade as " A Great Master Printer," is due the credit of selecting the first type for the practical work of the Borough Polytechnic printing class, and the Institute owed much of its success in its printing work to his advice. Mr. Jones had been a teacher himself and done good work in Leicester and Edinburgh.

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[1] A reproduction of the original design is shown on pp. 104 and 105. The block for this was kindly made by Mr. A. J. Bull, of the L.C.C. School of Photo-engraving and Lithography.

The founding of what is known as the London School of Printing marks another period in the provision of technical education for Printers through the co-operation and financial support of the trade.

In 1914 the London County Council issued a valuable and comprehensive Report by J. C. Smail (Organizer of Trade Schools for Boys, and now Principal of the Heriot Watt College, Edinburgh) on " Training and Employment in the Printing Trades." The Report recommended the establishment of a Central School near Ludgate Circus and two subsidiary schools—one to be north of the Thames, either at Islington or at the proposed North-Western Polytechnic ; the other on the south side of the Thames at the Camberwell School of Arts and Crafts. In order to accomplish this the printing classes at the Borough Polytechnic, Regent Street Polytechnic and the Aldenham Institute were closed in 1919 and the Council withdrew its grants for printing classes in those Institutes. The Governors of the Borough Polytechnic protested against their successful printing classes being closed, and pointed out that Southwark was the proper place for a Central School for Printers and not the north of the Thames. The scheme for a School on the north of the river near Ludgate Circus was not finally carried out, but the classes in the Institutes named were closed and their students and work concentrated in St. Bride's Institute, which had become known as the London School of Printing, and the valuable type and plant of the Borough classes, worth over £1,000, was transferred there. The St. Bride's Institute classes were then transferred in 1922 to a building in Stamford Street, Blackfriars, where the work of the London School of Printing and Allied Trades has been developed, so that there is still a printing school in Southwark, the proper district for printing classes.

Employers have extended the privileges of their apprentices by sending them for four hours a week to classes during working hours, paying their wages and fees as in the days when they went to the earlier printing classes at 5.30 p.m. The School has about £30,000 worth of plant, either given or lent, and receives financial assistance of about £2,000 a year from various Trade Associations. With the concentration of printing students in one building and the privilege of apprentices to attend day classes during their apprenticeship there is naturally a large number of students (2,000) attending the School. There is a special whole-time course of three years confined to the sons of master printers. The School is managed by Representatives of the Trade and the London County Council, the Council contributing about £22,000 a year to the cost.

The North-Western Polytechnic has recently opened classes for the Printing Trades, and is the subsidiary school north of the Thames.

At the Central School of Arts and Crafts there is a " School of Book Production " in which Typography, Type Display, Compositors' Work and Machine Printing are taught, and there is a Junior Technical School for Printing for boys between 13 and 14 years of age. The conditions of admission to this School are that boys shall show fitness for the trade, be apprenticed to some firm of good standing, and remain in the School until they are 16 years of age, time at school being counted as the first two years of apprenticeship.

The Manchester College of Technology, whose Department of "Printing and Photographic Technology" is described under Photo-Engraving and Lithography, has a two-year full-time Day Course for those intending to enter the Printing Industry or who are already in the business and can spare time for a College course. There are part-time Day Apprentice Courses and Evening Courses for those engaged in Typography, Machine and Press Work, and Mechanical Composition.

There are other important Departments and Centres at which Printing Trade Subjects are taught, in Leeds Technical College, Birmingham Central School of Arts and Crafts, Derby School of Arts and Crafts, Leicester Colleges of Art and Technology, Merchant Venturers' Technical College, Bristol, and altogether over forty centres in England, Scotland (Heriot Watt College and Glasgow Technical College) and Ireland (Belfast Technical College) have classes and departments in Printing scheduled with the City and Guilds of London Institute for the Session 1930–1. At the 1931 examination held by that Institute 402 candidates sat, and 270 passed in the Intermediate and Final grade and 11 obtained the Full Technological Certificate.

XVI

PHOTO-ENGRAVING AND LITHOGRAPHY

The London County Council School of Photo-engraving and Lithography is interesting on account of its origin and development. The School of Photo-engraving in Bolt Court arose out of a conversation between two lithographic artists who happened to be working together upon a large litho-stone in 1892. At that time British workmen were finding the competition of men from Austria to be rather to their disadvantage because the Austrians were often better equipped as regards training and ability in drawing. One of the two lithographic artists in question, Mr. Baxter, happened at the time to be President of the Trade Union which included this branch of work, and he took steps to provide facilities for training the worker in the lithographic trade in order to be able to compete with Austrians and others. At this time photo-engraving processes were developing and were thought to constitute a danger to lithography. With a view to raising some funds a Workmen's Exhibition of art objects was held at the Agricultural Hall in 1893. In addition to the money raised by this Exhibition the Trade Union made a levy of a penny a week per member. A room was engaged in Clerkenwell, and classes in drawing were opened there in October, 1893. In this year the Technical Education Board of the London County Council had been constituted, and a deputation from the Union sought aid from it. There is an entry from the Minutes of the Board for March, 1894, stating that:

> "On inquiry we learned that these classes, though started by a trade union, were established on the broadest lines, and no students were refused admission who were willing to comply with the regulations of the School. . . . The students pay no fees, only the costs of the models. A subscription of one penny per week is made throughout the Society, and this provides for rent, lighting and cleaning. . . . The Society finds it impossible to provide sufficient remuneration for its teachers. . . . The Society now conducts classes for photo-process, and lectures on other branches, but these classes are practically at a standstill for want of apparatus. The photo-process involves an expensive plant, and at present most of the work goes to Austria for want of men able to carry it out in London. . . . One of the main objects of the School is to give to specialists a grasp of the whole trade, which they cannot acquire in the ordinary shops. . . . It is proposed that the School should develop photography for colour work."

The Board made a grant to the School and helped to find better premises. The London County Council became the tenants in 1894 of an old house in Bolt Court which had been the school of the Stationers' Company and comprised the headmaster's house, and ultimately took over the complete control of the Art School. At its inception the School gave a training in art work only, but the new premises in Bolt Court enabled a photo-engraving studio to be added, and in 1895 this was placed under the charge of C. W. Gamble. A School Committee was formed, of which Sir Emery (then Mr.) Walker was elected Chairman, a position he still holds.

The art and photographic studios were under separate direction until 1898, when C. W. Gamble was appointed Director and took over the entire management. Up to 1900 the School was known as the Bolt Court Technical School; its name was then changed to the London County Council School of Photo-engraving and Lithography.

In 1902 C. W. Gamble was appointed to take control of the Photo-engraving and Printing Department of the Manchester Technical College and was succeeded at Bolt Court by A. J. Newton. There was considerable development in the School about this time, and it was soon providing not only a fairly complete set of art classes, comprising drawing, design, composition and lithographic drawing, but in addition to the line and half-tone block making which was the first photo-engraving subject taken by the School, there were classes in collotype, photo-lithography and photogravure. During C. W. Gamble's time there had been a few day students, and while A. J. Newton was Principal this side of the work increased and the School began to acquire an international reputation and to draw students from the Continent as well as from the Provinces. In 1902 the total number of entries, day and evening, was 378; now it is over 1,000.

The old building became unsuitable to accommodate the increasing number of students and to meet the more exacting requirements of the different branches of photographic and engraving work as these processes developed. A new building was erected and opened in 1912, when A. J. Bull, who had been an assistant to, and associated with A. J. Newton from 1903 in the development of the work, was appointed Principal. The new building brought a larger number of students and for a few years there was plenty of room, but after the War the accommodation again proved inadequate and about 1926 three floors in an adjacent building were added and connected by a bridge to the original school. This extension enabled better accommodation to be given to the photogravure and photo-lithographic work, and a chemical and physical laboratory was added. This laboratory has been particularly useful to the classes in paper technology. The number of applications for admission to the School is still growing and it is impossible to find room for all who wish to attend the evening classes.

The scope of the teaching comprises everything in the production of illustrations of various kinds. The art classes give a training in drawing for reproduction and lithographic work while the more technical classes provide for the photography of objects for reproduction, and all the stages of making line and half-tone blocks in monochrome and colour, photo-lithography and photogravure. All the work is carried as far as the production of proofs.

In addition to the evening classes, there is a Senior Day School for young men who come for a two-year course, generally with a view to training for some definite branch of the work. Some come for shorter periods. During the last ten years such students have come not only from this country but from most of our Colonies, Dominions, China, and the United States.

In 1912 a Junior Day Technical School was organized for boys, who attend a two-years' course with a permissive third year which allows time for placing them in the trade; and in doing this no difficulty has so far been experienced.

The full-time teaching staff has always been interested in experimental work, and from 1905 numerous original papers have been published, but only when there was something of real value to put forward.

There is a School of Engraving and Etching at the Central School of Arts and Crafts, in which Lithographic Drawing on stone or any of the substitutes in use to-day is taught. The London School of Printing has a Lithographic Department and also gives instruction in Photogravure, Photo-Lithography and Collotype, but these subjects appear to be ancillary to the main work of the School, which is that of printing and other allied trades.

The Manchester Municipal College of Technology has a Department of "Printing and Photographic Technology" which is devoted to the Printing Industries, and under this head is included Letterpress Printing, Wood-engraving, Photo-engraving, Lithography and Bookbinding.

The Department opened in September, 1902, as the outcome of a recommendation (1901) of a Sub-Committee appointed to consider the Organization of the Municipal Technical School on its establishment in the New Building of the Municipal College of Technology in Sackville Street. At that time there were in the Technical School in Princess Street classes in certain branches of the Printing Industry and there was some equipment. There had also been some lectures in Photography, but there was no organization for making a complete unit. It is claimed that the decision of the Manchester Committee to make such a unit as complete as might be practicable was the first effort of the kind in Great Britain.

J. H. Reynolds (the Principal) and Alderman Heywood visited the London County School of Photo-engraving and Lithography and had an interview with the Principal, C. W. Gamble, with the object of obtaining advice in carrying out the recommendation of the Manchester Committee. As a result of this interview Mr. Gamble was asked to prepare a Scheme for the Organization of the Department, and his scheme (eventually adopted by the Committee) was that a Department should be formed, under one Head, which should deal as far as might be practicable with the whole of the Crafts involved in the production of an illustrated book. Mr. Gamble was appointed Director of the Department and took up his duties in August, 1902.

Full-time day courses extending over two years are held in Pure Photography and in Photo-Mechanical Processes.

Part-time Day Apprentice Courses occupying two years are held for those engaged in Photo-engraving, Lithography (Drawing) and Lithography (Printing). Evening courses are held in Lithographic Printing, Pure Photography and Photo-Mechanical Processes.

The City and Guilds of London Institute holds Examinations in (*a*) Photography (Pure, Practical and Commercial), and (*b*) Photo-engraving. In 1931 23 candidates sat for examination in these two subjects, of whom 3 passed the Final grade in Photography and 11 passed the Inter and Final examination in Photo-engraving. In Lithography there were 30 candidates, 22 being successful in the Inter and Final examination.

XVII

BOOKBINDING

The People's Palace, Mile End, had a class for Bookbinding in 1892 which was more or less intended for Art Students; the first bookbinding classes connected with the trade were formally opened at the Borough Polytechnic Institute in October, 1893, by the late J. W. Zaehnsdorf, the well-known master bookbinder, of whom it is said that there is hardly any library of importance which does not possess examples of his admirable craftsmanship. He spoke of the value that such instruction would be to working bookbinders engaged in either the forwarding or finishing branches of the trade. The class in the former branch was conducted by T. S. Parrott and in the latter by F. Maullen, who held a diploma from the Society of Arts for excellence in design and workmanship. Both teachers held responsible positions with J. W. Zaehnsdorf, who at the opening of the classes presented twenty-four copies of the second edition of his well-known book (now in its eleventh edition) on the *Art of Bookbinding* to the first students who joined the class. An extra copy was presented by him to the Author with instructions for the class as to binding it for him, and this book is one of his cherished possessions as a beautiful specimen of binding done in this, the first trade class in Bookbinding. The classes were cordially approved by R. King, Secretary, and by the Committee of the Bookbinders'

Society, and were very successful until 1919, when, as with the printing classes, they were closed under a scheme of co-ordination, in favour of the London County Council classes in bookbinding which had then been opened at the Central School of Arts and Crafts, Southampton Row, under Douglas Cockerell, and at the Camberwell School of Arts and Crafts.

A class opened in 1900 at the Northampton Polytechnic, Clerkenwell, under F. Sangoriski, was also closed in 1916 under the same co-ordination scheme. Classes were opened in Liverpool in 1895 in which J. Fazakerly took great interest, and sent two of his best men as Teachers of Forwarding (W. J. Elton) and Finishing (J. H. Haines). The City and Guilds of London Institute held its first examination in this subject in 1895, and at these examinations, during the first eleven years of the existence of the Borough Classes, the students gained twelve silver and thirteen bronze medals, 70 Final grade and 147 Grade I certificates, in addition to London County Council Art Exhibitions—a good record for working bookbinders.

A book by Edric Bayley, giving an account of the Origin and Development of the Borough Polytechnic Institute, published in 1910, was specially bound at the Institute for and accepted by H.M. King Edward VII, for the King's Library.

At the L.C.C. Central School of Arts and Crafts there is a special Department of Book Production in which Bookbinding is a section with evening classes confined to trade students on three evenings a week. There is a Day Junior School, for boys between 13 and 14 years of age who show fitness for the trade of Bookbinding. It is required that the boys shall be apprenticed to some firm of good standing and shall remain in the School until they are 16 years of age, the time spent in the School being counted as the first two years of apprenticeship.

The London School of Printing has a Bookbinding Department for Machine Binding, classes in Designing and Finishing for Bookbinders engaged in handwork and a Bookbinding Department, Women's Section.

The Manchester College of Technology has part-time two-year Day Apprentice Courses for those engaged in Bookbinding. It also organizes Evening Courses extending over four years.

Bookbinding classes are held in Schools of Art and Technical Institutes in other parts of the country.

On the results of examination in Bookbinding by the City Guilds Institute the Skinners' Company offers in *each* section (Forwarding and Finishing) a Prize of £2 for Final Examination, and First and Second Prizes of £1 10*s*. and £1 respectively. In the 1931 examination 21 candidates sat for the Final certificate and 13 were successful.

XVIII

CABINET-MAKING AND FURNITURE TRADES

In Finsbury, the seat of the furniture trades, there were two notable men who were interested in technical education especially for these trades: Mr. (after Sir) J. Williams Benn and Benjamin Lucraft. The former was Proprietor of several trade papers and Editor of the *Cabinetmakers' Journal*. He gave evidence before the Royal Commissioners on Technical Education in 1882, and lent his Office in Finsbury Pavement for meetings of a small body of men who gave evidence on other trades at the same time. Out of this grew the Artisans' Technical Association. Benjamin Lucraft was a cabinet-maker and one of the early members of the School Board for London.

In 1881 a Memorial, signed by over sixty firms engaged in cabinet-making and house-furnishing trades in Shoreditch and Finsbury, was presented to the Council of the City and Guilds of London Institute, calling attention to the absence of any provision for instruction in this branch of industry in the scheme of work proposed at Finsbury Technical College. The Council promised to give careful consideration to the Memorial, and in 1882 a course of instruction was arranged under A. F. Brophy (Head Master of Applied Art Department) to include lectures and practical work " for those who are engaged, or about to be engaged, in the cabinet-making industry."

The workshop instruction was given at first by H. Staynes, an expert joiner and fine woodworker, and in 1886 by J. Whitty, an experienced cabinet-maker.

In 1883 a class for cabinet-makers, under A. A. Moore, was opened at the Regent Street Polytechnic.

In 1893 the late Shoreditch Vestry provided instruction in a house rented in Hoxton Street, Shoreditch, in such subjects as cabinet-making, carving, plumbing, etc.

In 1898 the London County Council acquired the Askes' Haberdashers' Schools in Pitfield Street, Hoxton, for the purposes of a central Technical School. The site comprised an area of about 1½ acres, and, being situated in the very centre of the wood and furniture trades, and at the same time within easy access of Hackney, Islington and the East End, was admirably fitted for a technical school suited to the industries of east and central London. Four new workshops were erected and repairs and alterations made to the old buildings at a total cost of £27,679, of which £21,000 was for the site and schools. The buildings were completed and ready for use in October, 1899, and were named the Shoreditch Technical Institute. Shadrach Hicks was appointed Director. The Shoreditch Municipal School Classes were transferred to the Institute and arrangements were also made for the discontinuance of the trade classes of the Finsbury Technical College and the transfer to the new institute of the students attending those classes. Thus the nucleus of the Shoreditch Technical Institute was formed with about 200 students. This number was increased to 475 evening students in the first session. The new buildings afforded an opportunity not only of meeting the great demand for cabinet work, for which subject over 100 students were enrolled during the session, but also of opening new classes in upholstery, joinery, metal and art work peculiarly associated with cabinet-making.

A Junior Technical School was opened on January 22nd, 1901. The object of the School was, as stated, to enable boys who intended to enter some branch of the furniture and other wood-working trades, either as cabinet-makers, carpenters, joiners, shopfitters, turners, woodcarvers, or draughtsmen, to acquire such a knowledge of the artistic principles of design, the scientific principles of construction, of the properties of materials and the use of tools as would enable them to enter a workshop with profit to themselves and to their employers. The success of the Institute made it necessary to build new workshops and classrooms, at a cost of £5,490, and these were opened in May, 1905. In a Paper, before the Association of Technical Institutions, in 1930, on Technical Education Work of the London County Council, by the Education Officer (G. H. Cater) it was stated that proposals are afoot to make the Institute into a School devoted exclusively to the furniture trades and to expand its activities to cover every possible side of these trades. If these proposals are carried into effect we may hope at last to have a school in London comparable with the " École Boulle " in Paris.

In addition to the Shoreditch Institute, there are four other senior institutions where day or evening instruction is given in the furniture trades. At the Central School of Arts and Crafts there is a special " School of Furniture." The School of Woodcarving at Kensington is devoted to woodcarving only. In the provinces there are classes in cabinet-making, scheduled with the City and Guilds of London Institute, in the principal towns in Lancashire, Yorkshire, the Midlands, East, West and South of England, and in Ireland.

Since 1894 the City Guilds Institute has conducted an examination in Cabinet-making, and in 1931 the number of candidates was 86, of whom 31 passed the Final grade and 16 in Grade I.

TECHNICAL COLLEGE, FINSBURY

(see p. 14)

SESSION 1882–3

The following Special Courses of Evening Lessons, covering a period of Three Years, have been arranged for Apprentices, Journeymen and Foremen engaged in any of the branches of the

CABINET-MAKING INDUSTRY

First Year's Course

1. Technical Drawing.—Joints, Mouldings, including Cornices, Plinths, Columns, Caps, Bases, etc. The practical setting out of working drawings from sketches or scale drawings.
2. Perspective and Model Drawing.
3. Freehand Drawing.
4. Plane and Solid Geometry.

Second Year's Course

1. Technical Drawing, Advanced Course.—The application of Geometry to Cabinetwork as required in enlarging and diminishing Mouldings, etc. The drawing of articles of furniture by actual measurements of objects, in plan, section and elevation; from engravings, photographs, etc.
2. Freehand Drawing.—Ornament, Panels, etc.
3. Art Furniture and Fittings.—Lectures.
4. Modelling from casts.

Third Year's Course

1. Design.—The designing of original pieces of furniture in various styles. The production of working drawings, with full and complete details. The preparation of complete drawings from given sketches.

2. Styles and Ornament, historically considered.

3. The Technology of Woods. Structure and strength of wood. Treatment of different kinds of woods as regards warping, shrinking, etc.

Also one of the following:

4. Modelling from life for Wood Carvers.

5. Technical Painting.—For Panel Painters, Decorators, etc.

6. Inlaying—With Woods, Metals, Mother-of-Pearl, etc.

The Students have the opportunity of working out many of their designs, and of seeing practically illustrated the principles of Joinery in the College workshops.

Apprentices admitted at half the ordinary fees.

XIX

GOLDSMITHS' AND SILVERSMITHS' WORK

The following extract from a Report of the Artisans' Institute, read at an "Inaugural Soiree" on October 14th, 1874, is worth quoting:

> ". . . 205 members were enrolled in the course of the first quarter, about 120 of whom entered for the classes. About 40 of these belonged to the Goldsmiths' and Jewellers' Association and were entered for its technical drawing class (specially asked for by their able secretary, R. J. Galbraith."

The rules of this Association provided a scheme of technical education for youths in the trade, as well as a sick benefit and trade society for the men.

This was probably the first special technical class for the workers in these trades; how many years it continued to exist there is no trace; but it is known it was not in existence in 1877. The Worshipful Company of Goldsmiths opened a class about this time for silversmiths' drawing and modelling in Upper Charles Street, Clerkenwell, under Mr. Mayer. This was closed in 1884.

Evidently there was a feeling that some technical education was needed, for in 1880 an examination paper in Silversmiths' Work was prepared by Mr. James Garrard for the City and Guilds of London Institute, but no candidates presented themselves for examination until 1884, when there were 5, of whom 3 passed.

In 1885 there were 10 candidates and 6 passes; 5 of these were from the Regent Street Polytechnic, an Institute which had opened in 1883 a class in theory relating to silversmithing under Mr. Hunter, a Master Silversmith. This class was continued until business engagements compelled him to retire. Practical demonstrations were given at intervals, in modelling and plaster casting by Mr. Worral (Mappin and Webb's Designer) and R. Owen, the silver caster, sent along one of his men at times to show how sand casting was done. Good classes for the theory of goldsmithing and jewellery, chasing and repoussé working under skilled teachers were also held at the Polytechnic.

W. Augustus Steward, in an address on "Workers in Precious Metals" delivered in September, 1892, at the South Place Institute, Finsbury (see *Workers on their Industries*, edited by F. W. Galton), referred to the difficulty of securing good teachers able to give time in the evenings at small remuneration, and asked: "Is it not possible to hope for a good central institution, under the control of some democratic authority, such as the London County Council, where first-class instruction could be given regularly?"

In 1896 this was obtained by the opening of the London County Council's School of Arts and Crafts at Morley Hall, Regent Street, opposite the Polytechnic, with Sir George Frampton and W. R. Lethaby as Directors. Later W. R. Lethaby became Principal. The classes held there were transferred, in September, 1908, to a building in Southampton Row erected specially for the purpose, now known as the Central School of

Arts and Crafts. W. Augustus Steward became Head of the Silversmiths' School there; and incidentally, as bearing on the training of technical teachers, it may be mentioned that he and C. Welch, his chief assistant, were students at the Goldsmiths' Company class in Clerkenwell.

The School of Silversmiths' Work and Allied Crafts gives instruction, in day and evening classes, in silversmiths' work, goldsmiths' and jewellers' work, diamond mounting, enamelling, engraving, chasing and repoussé work, die-sinking and metal casting, and has a staff of eleven instructors, eight of whom have been students at the school.

There is a day Technical School for boys of 13 years of age who show fitness for the trade. One condition of admission is that the boys shall be apprenticed to some firm of recognized standing and remain in the School for three years. The time spent in the school is counted as the first two years of apprenticeship.

The Worshipful Company of Goldsmiths awards Prizes, to the boys of the day school and to evening students, Scholarships tenable at the Central School of Arts and Crafts of the total value £255, and a Travelling Scholarship of £200. Candidates must have been students of Goldsmithing and allied Crafts.

The Northampton Polytechnic Institute, Clerkenwell, opened an Arts and Crafts Department in 1896 with J. Williams as its Head. Classes were held in Silversmiths' Work under A. J. How; in Goldsmiths' and Jewellers' Work under H. Stapleton; in Engraving, Chasing and Embossing under B. Jenkins and C. Koester respectively. These classes were closed in 1916 at the request of the London County Council and their work transferred to the Central School of Arts and Crafts in Southampton Row.

The City of Birmingham began to pay special attention to Craft and Art instruction in their Municipal School of Art about 1886 (under E. R. Taylor as Head Master), and has done much good work for silversmiths and other metal workers, good results being shown in the manufactures of Birmingham. The Author referred to this in a Paper on "Trade Schools for Boys and Girls," read at the meeting of the British Association (Section L) at Leicester, August, 1907. This Paper was subsequently revised and printed in Professor (now Sir) M. E. Sadler's book on *Continuation Schools in England and Elsewhere*, from which the following extract is given:

> "As showing the value of close co-ordination between the elementary school and the trade or technical school, to which the boy will go on and in which the nature of his future employment will be taken into consideration throughout the course, I may mention what has been done for many years in Birmingham for silversmiths and other metal workers at the Municipal School of Art. By a wise arrangement the Art School is kept in touch with the drawing done in the elementary schools, and bright boys are passed on at about 13 to be day students in the Art School, where they spend a year or two receiving lessons under the art masters in drawing and in various branches of metal work under skilled craftsmen-teachers. The result is that these boys are eagerly sought after by the metal workers of the town, very many rising to excellent positions with good wages. This would not have been possible but for the liberality of Alderman Kenrick, who paid out of his own pocket 5*s.* a week wages to boys attending the school, an allowance which enabled them to be kept from going out to work during the requisite period of the school training. Though not certain on this point

I believe that this was the first form of industrial scholarship providing maintenance for young workers in this country."

The craft work at the Art School developed into the special trade school for Jewellers and Silversmiths. In 1887 an evening Branch Art Class under T. B. Wigley was opened in the Ellen Street Council School for the training of those engaged in the jewellers' quarter. This class grew rapidly and in 1890 a factory in Victoria Street was bought and converted into a Branch School of Art. The Museum and School of Art Committee was responsible for the classes in the art section, and the Birmingham Jewellers' and Silversmiths' Association controlled the technical or trade class section. The dual control was not a success and in 1902 all the classes were placed under a Joint Consultative Committee consisting of representatives of the School of Art Committee and of the Jewellers' Association. A Head Master (R. Catterson Smith) was then appointed to take charge of the School. The Jewellers' Association agreed to pay £450 a year towards his salary, and continued this contribution until 1915. R. Catterson Smith was appointed Head Master of the Central School of Art in 1903 and A. J. Gaskin was appointed Head Master of the Victoria Street School. He retired in 1924 and was succeeded by W. T. Blackband.

In recent years the Association has provided a number of scholarships and prizes besides paying half the fees of students who were employed by members of the Association. The Worshipful Company of Goldsmiths also makes a grant of £200 a year for scholarships.

The School is specially organized to assist workers engaged in the various branches of the metal industry and a number of the students attend two or three afternoons a week as well as evenings.

A Junior Technical School for Silversmiths, Goldsmiths, Brassworkers, is also held in the School and about 60 students training as metal workers are in attendance. The age of entry is 13 and the course of study three years.

In Sheffield, the classes in Silversmithing and Kindred Trades form part of the work of the College of Arts and Crafts, in Arundel Street. The present building, erected in 1855, was called the School of Art until November, 1926. It was transferred to the Sheffield Corporation in December, 1901.

It is difficult to obtain authentic information regarding the early classes in Silversmithing, but in 1893 (when the late J. T. Cook was Principal) part-time evening classes were held in chasing and engraving, the former being taught by H. Archer. A. C. Jahn was Principal from 1905 to 1925, and in 1906 the work of the School was extended. Fully-equipped workshops were added for instruction in silversmithing, flat-hammering, mounting, engraving, chasing, enamelling and die-sinking under specialist instructors. At present S. Wilkinson is full-time instructor in silversmithing and engraving, and H. Thorpe part-time instructor. Mr. Wild is instructor in die-sinking.

The Principal of the College is J. E. Sunderland, A.R.C.A.

In the City and Guilds of London Institute Syllabus for its Examination in Goldsmiths' and Silversmiths' Work it is stated that the object of these examinations is to encourage a wider knowledge of all branches of the craft than can usually be obtained under the economic subdivisions necessary for commercial purposes and to stimulate an artistic sense amongst the workers.

On the City Guilds Institute Advisory Committee for Goldsmiths' and Silversmiths' Work, Jewellery and Die-sinking, are representatives of the Board of Education, Worshipful Company of Goldsmiths, Manchester and City of Sheffield Education Committees, Association of Technical Institutions, Birmingham Central School of Arts and Crafts, National Society of Art Masters, Design and Industries Association, Birmingham Jewellers' and Silversmiths' Association, Sheffield Master Silversmiths' Association, The Manufacturing Silversmiths' Association, London and the City Guilds Institute.

At the examination in 1931 in the Inter and Final grade 29 candidates sat, of whom 18 passed.

The Worshipful Company of Goldsmiths offer Prizes of £3 and £2 in the Final examination in each of the subjects of Goldsmiths' and Silversmiths' Work, and in Precious Metal and Gem Work. The Company has authorized the insertion of the following Note to the syllabus of the examination in Goldsmiths' and Silversmiths' Work :

NOTE.—SUBMISSION OF WORK TO THE GOLDSMITHS' COMPANY

The work of candidates in the examinations who, in the opinion of the Examiners, show special promise, will be sent to Goldsmiths' Hall for submission to the Judges appointed by the Goldsmiths' Company.

This will bring candidates into touch with the various schemes which are being promoted by the Company to assist designers and good craftsmen in the trade, and their names will be noted in the Company's registers.

Any candidates who may show consistent outstanding ability may be commissioned by the Company to make a specimen piece or pieces for the Company's permanent collection of modern work, and eventually considered for possible admission to the Freedom of the Company in virtue of their artistic and technical qualifications.

XX

TEXTILE INDUSTRIES

The textile industries cover so much ground and are so varied in character that, within the scope of this book, only a brief outline can be given of what has been done for them in technical education. Prominent men more or less connected with the industries, such as Mr. (later Sir) Swire Smith, Worsted Spinner, Keighley; J. A. Brooke, Woollen Manufacturer, Huddersfield; J. Cramp, Ribbon Manufacturer, Coventry; Sir Joseph Lee, Cotton Spinner and Calico Printer, Manchester; Joseph Leigh, Cotton Spinner, Stockport; H. S. Cropper, Engineer and Machinist, Nottingham, and Mr. (later Sir) William Mather, M.P., were firm believers in technical education and their opinions as to its importance and value were expressed, with those of men engaged in other industries, in a little book, *The Industrial Value of Technical Training* (Some Opinions of Practical Men), a "Reprint, by permission, from the *Contemporary Review*, May, 1899," and published by the National Association for the Promotion of Technical Education. This little book, with its prefatory note by the Marquis of Hartington, M.P., and the concluding note signed Henry E. Roscoe and Arthur H. D. Dyke Acland, undoubtedly had much to do with the passing of the Technical Instruction Acts.

It would be difficult to estimate how much education for the Textile industries owes for its development to the liberality of the Worshipful Company of Clothworkers, which provides annual grants and has made donations to technical institutions in the provinces, especially to Leeds University (see p. 68, T.E.). In the provinces a total sum of £340,000 has been expended by the Company to 1931.

Since 1904 valuable Scholarships and Exhibitions have been awarded by the Worshipful Company of Drapers to deserving students in the Textile Industries, on the results of the Examinations of the City and Guilds of London Institute.

Cotton Manufacture and Silk Manufacture were two of the earliest subjects in which technological examinations were held by the Society of Arts in 1873. John Cheetham was the Examiner in the former, and Francis Cobb the Examiner in the latter subject. In the same year the Worshipful Company of Clothworkers nominated Joseph Crosland as Examiner in Cloth Manufacture; in 1874 Joseph Wrigley acted as Examiner. In the Programme of Examinations in 1874 the announcement was made that the Clothworkers' Company would award a Scholarship of 100 Guineas to the best candidate in Cloth Manufacture presuming that, in the opinion of the Council, he reached a sufficiently high standard. The Scholarship was given in order that the holder might spend at least one year at an approved place of scientific instruction.

In 1879, which was the first year in which the City and Guilds of London Institute undertook the technological examinations hitherto held by the Society of Arts, examinations were offered in Cotton Manufacture—Examiner, J. Butterworth; Silk Manufacture—Examiner, Francis Cobb; Cloth Manufacture, and also in Silk

Dyeing—Examiner, T. Dickins; and Wool Dyeing—Examiner, G. Jarswain. But candidates in Cotton Manufacture presented themselves only to the number of 33, and in Wool Dyeing to the number of 4. In 1880 the same subjects were offered, and numbers began to increase; 58 candidates presented themselves in Cotton Manufacture, 27 in Cloth Manufacture, 23 in Silk Manufacture, and 20 in Dyeing Subjects. At the outset the candidates in Cotton Manufacture were mainly drawn from Bolton and Oldham, and in Cloth Manufacture from Huddersfield. The Examiner in 1880 in Cloth Manufacture was Joseph Wrigley. In that year Lace Manufacture was also added as a subject of examination, with Mr. Doughty as Examiner, but no candidates presented themselves.

In 1881 the numbers had risen to 112 candidates in Cloth Manufacture, 146 in Cotton Manufacture, and 18 candidates in Wool Dyeing.

In 1882 the addition of a separate examination in "Weaving and Pattern Designing" had the effect of diminishing somewhat the number of candidates in Cloth Manufacture and in the manufacture of textile fabrics generally.

In 1883, 5 candidates presented themselves for the first time in Jute Manufacture.

In 1884, in addition to the written examinations, candidates in Weaving and Pattern Designing were required to send up to the Institute specimens of their work for examination. The number of candidates in Cloth and Cotton Manufacture had increased to 172 and 662, and there were 358 candidates in Weaving and Pattern Designing. In 1884 for the first time there were entries for Lace Manufacture to the number of 19 from Nottingham.

In 1885 the first examination in Framework Knitting was held at the Technical School, Leicester, where the first classes in this country for Hosiery and Framework Knitting were established.

In 1888 the examination in the general subject of Weaving and Pattern Designing was discontinued, and new syllabuses were prepared for the separate subjects of Spinning of different kinds of yarn, and for Weaving in respect of both Woollen and Worsted, Cotton, Silk, Linen and Jute. The examinations in Cotton Spinning and Weaving as such were held for the first time in 1889, and have since formed one of the most important branches of the Department's work, with the largest number of candidates.

In 1894, the expenses of an Inspector to visit the classes in textile subjects and report on the instruction given therein were defrayed by the Clothworkers' Company.

In each subject the records show the gradual extension of the period of study contemplated by the syllabuses from one year to two years, and thence to three and four years. The Third Year Examination in Textiles was first brought into action in 1898, and the same extension followed in Silk Spinning and Weaving in 1900. In that year the records of the City Guilds Institute's Department of Technology show that twenty-five separate examinations were held in the technology of Textiles in addition to practical tests.

In 1900 the Institute, again through the liberality of the Clothworkers' Company, added to its staff an Inspector to take charge specially of Cotton Manufacture. The post was held for many years by John Crompton, M.Sc., who by his visits and helpful advice to the classes and teachers in Cotton Spinning and Weaving largely contributed to the raising of the standard of technical education in that important industry. The functions of the Clothworkers' Inspectors ceased when the work of inspecting technical classes was taken over by the Board of Education in 1915. The services rendered to textile education by the Institute's inspection of classes was suitably acknowledged by the Board of Education.

A *viva-voce* examination to determine the award of prizes in Cotton Spinning and Cotton Weaving was first established in 1902, and in the same year a comprehensive scheme for scholarships in Textile Subjects was prepared by the Worshipful Company of Drapers, which offered for competition in 1904 five Scholarships in Weaving Subjects and twenty Exhibitions in the Spinning or Weaving branches of any textile industry.

During the period of years 1904–31, 170 Scholarships and 453 Exhibitions have been awarded by the Drapers' Company, to a total money value of £27,919, in which is not included the annual contribution made directly to the expenses of the City and Guilds of London Institute.

In 1905, at the suggestion of the Institute's Cotton Advisory Committee, all candidates in Cotton Manufacture were required to produce evidence of having the necessary knowledge of arithmetic, drawing, and elementary physics before being admitted to the First Year's examination in the technology of the subject. It was about this time that the Board of Education issued regulations that students should not be admitted to evening classes who, from want of sufficient preliminary training or other cause, were not qualified to take advantage of the instruction.

In 1905 a separate examination in the "Principles of Art as Applied to Textile Design" was commenced.

In 1914 the syllabus in Cotton Weaving was for the first time divided into separate sections for Plain Weaving and Plain and Fancy Weaving to suit different districts. The syllabus in Woollen and Worsted Weaving had for many years been divided into two separate sections corresponding broadly to the local requirements of the trade.

From this time the number of candidates steadily increased until a total of 2,335 for all examinations in textiles and subjects allied thereto was reached in 1931, when 1,686 successes in Grades I, II, Final and various Sections and years were gained.

[In Appendix I, Table III, details of passes in each subject are given from a Report of the City and Guilds of London Institute.]

MONEY PRIZES

Money Prizes are offered by the Clothworkers' Company varying from £3 to £2 10*s*. for successful candidates in the Final Examination, and £2 10*s*., £2 and £1 respectively for First, Second and Third Prizes in Grade II, in:

(*a*) Each of the Subjects 25A (Woollen Yarn Manufacture) and 25B (Worsted Yarn Manufacture).

(*b*) Each division of Subject 26 (Woollen and Worsted Weaving and Design).

(*c*) Cotton Spinning and in Cotton Weaving (Sections A and B).

(*d*) Each section of Linen Weaving and Jute Weaving.

(*e*) In Flax Spinning; in Silk Throwing and Spinning; in Silk Weaving; in Jute Spinning; in Principles of Art as applied to Woven Fabrics for Designers and for Fabric Printers.

On matters connected with its examinations in Textile Industries the City and Guilds of London Institute is able to avail itself of the advice of the following Advisory Committees:

Cotton Spinning and Cotton Weaving. The Advisory Committee and Examinations Board of the Union of Lancashire and Cheshire Institutes.

Silk and Rayon Courses. The Advisory Committee of the Joint Industrial Council for the Silk Industry, on which are Representatives of the Macclesfield Technical School, Nottingham University College, Board of Education, City and Guilds of London Institute and the Joint Industrial Council for the Silk Industry.

Hosiery and Knitted Goods. The Advisory Committee on Hosiery Training on which are Representatives of the Hosiery Advisory Committee of Loughborough College, Nottingham University and Leicester College of Technology; the Hosiery Departments of Loughborough College, Leicester College of Technology, and Nottingham University; the National Joint Industrial Council for the Hosiery Industry, the Worshipful Company of Framework Knitters, the Board of Education, the City and Guilds of London Institute and Association of Education Committees; the Counties of Nottingham, Leicester and Derby; the County Councils' Association and East Midland Educational Union.

The Textile Institute

The Textile Institute for which a Royal Charter was granted on 11th March, 1925, was founded by textile technologists and has two classes of membership—Associates and Fellows. The qualifications for membership are: (1) Scientific and technical knowledge, (2) practical experience, and (3) substantial contributions to textile technology.

The Institute, by encouraging efficient technical training, is doing for the Textile Industries what the several Institutions, previously mentioned, of Engineers, of Builders, of Carpenters, of Decorators, of Boot and Shoe Manufacture and other bodies are doing for their respective industries and trades.

The following papers on Technical Training for the Textile Industries were read at the Annual Meeting of the Association of Technical Institutions on the 25th and 26th February, 1927:

(1) "The Technical Training of Students for the Cotton Industry," by Wm. Wilkinson, Head of the Blackburn Technical College.

(2) "Technical Training for the Worsted and Woollen Industries," by Eber Midgley, Professor of Textile Industries, at Bradford Technical College.

Both of these papers are of interest and extracts are given from each paper. Mr. Wilkinson says:

"It is very important to note that a large number of the leading experts in the Cotton Industry and at least 40 per cent. of the works managers and foremen are men who were students in the textile schools twenty to thirty years ago.

"These men are the driving force responsible for the present relationship between the industry and the schools, and it is quite true to say that twenty-five years ago was a 'critical period' in the history of technical education so far as the cotton industry is concerned.

"It is often suggested that the value of technical education is difficult to estimate. What better example have we than the Cotton Industry? Imagine for a moment what the position would be to-day if for some reason the scheme had been dropped twenty-five years ago. The men who have guided us so successfully through the abnormal depression and helped to make a comparatively new trade, are those who were *trained in the textile classes in years gone by.*"

Professor E. Midgley says:

"The standard attained is such that it can be stated that *Textile Schools of this country provide a higher and more complete training in pure Textile Technology than is offered in any other country in the world.*"

XXI

TECHNICAL EDUCATION FOR WOMEN

Technical education for men began to be understood and its importance appreciated from 1874, and from 1884 onwards it developed rapidly; but nothing appears to have been done to meet the educational requirements of women workers, other than clerical, before about 1892. True, there were classes for girls in the Home Arts or Domestic Economy subjects, as they were called—Plain Needlework, Dressmaking, Laundry Work and Cookery—but, as their name implies, these classes were not of a professional or commercial character, and the first two subjects were generally taught in schools by Schoolmistresses, and the last two subjects were taught in centres by Domestic Economy Teachers. There appears to have been but little idea of the necessity for broad training of girls and women in craftwork. Except those who were apprenticed in good workrooms or in large households where they worked in service under well-trained servants, there was no instruction to be obtained of either a preparatory or a supplementary character. Training for girls was not considered necessary, probably because the idea at the back of the minds of women at that time was marriage, and hence preparation for home occupations. In Paris the Professional Schools for girls and young women had done much for the training of women in such occupations as Dressmaking, Millinery, Artificial Flower-making and Cookery, with the result that in the first two occupations at least Frenchwomen were employed in England at good salaries in good positions in the best workrooms, and English women had to work under them.

When the Borough Polytechnic Institute opened in 1892 with its large number of evening students, women and men, the discrepancy between the provision for men and the demand for technical education on the part of men in many trades, and what was done for women, became very apparent to all thinking persons. There were evening classes in Shorthand, Book-keeping, English, French, German, Art, Needlework, and Domestic Economy Subjects suitable and useful for women engaged in clerical occupations and work in their homes, but there was nothing for women engaged in craft occupations corresponding to those for men. The Authorities of the Institute began to pay attention to this matter and found the principles governing the instruction of the evening trade classes for men and the Day School for boys and the experience gained there were useful. A class for Professional Dressmakers was opened in 1894 under a specialist teacher who had good workroom experience. At the Battersea Polytechnic a similar class was opened, and both these classes were well attended, mostly by workers from business houses in the West End of London and good business houses in the suburbs. The late hours at which women left work (compared with those of men) made attendance at the classes difficult, especially for girls and young women, and representations on this subject were made later to certain business houses, with the result that leave was granted to enable girls and young workers to attend classes which were opened earlier—5.30 or 6 o'clock—for them.

This led gradually to the consideration of Day Classes and to the establishment of Day Trade Schools for Girls. The first Trade School for Girls began work at the Borough Polytechnic Institute in October, 1904, with 11 pupils. This pioneer experiment in technical education arose from the recognition of the fact that the provision of technical instruction for women workers engaged in trades was altogether insufficient. Although a few Evening Trade Classes existed, these for various reasons, economic and social, were inadequate for the purpose. To enable young women workers to attain a higher degree of manual skill and efficiency it was felt that technical instruction should precede, not follow, entrance into the industrial world. The Technical Training Committee of the Women's Industrial Council had carefully investigated various women's trades, and the name of Mrs. G. M. Oakeshott is associated with most necessary preliminary work. She placed her knowledge at the service of the Governors of the Borough Polytechnic, who selected Waistcoat-making (bespoke work) for the experiment, and obtained a grant from the London County Council for one year toward the expense of the first Day Trade Class for Girls. A Committee of the Institute was formed with the Hon. Maude Stanley, Mrs. Ramsay Macdonald, Mrs. G. M. Oakeshott and Miss F. M. Durham (then Secretary of the Women's University Settlement, Blackfriars, Apprenticeship Committee) as members, and Miss Helen M. Smith (Lady Superintendent), an enthusiastic worker in the cause of trade classes for women. By the end of the year success was sufficiently assured for the County Council to sanction the establishment of two new classes, Dressmaking and Upholstery. Trade experts generously gave their time and services in supervising the work and directing it on to right lines.

In the spring of 1906 the County Council established its system of Trade Scholarships and opened Day Trade Schools at other centres, the first being at Bloomsbury in 1907. From that time the growth of the Borough school was rapid. Ladies' Tailoring, Embroidery (hand and machine), Cookery and Laundry work were added, and when additional accommodation was provided in 1911, there were 173 pupils in attendance. There are now over 200.

There are now eleven Trade Schools for Girls in London in which three or more trades are dealt with according to the locality and needs of industry. The trades taught are Dressmaking, Ladies' Tailoring, Lingerie, Millinery, Embroidery (Hand and Machine), Waistcoat-making, Upholstery, Hairdressing, Laundry-work, Cookery, Domestic service, Tea-room Management and Cookery, and Photography.

Miss N. Adler, L.C.C., was an active supporter of these schools from their inception; and much credit is due to the ardent band of early workers, named above, for their pioneer work. One great advantage of the Girls' Trade Schools is that, having full-time Trade Teachers who are skilled workers with good workroom experience of the occupations they teach, it is possible to have good evening classes for professional workers and so provide technical instruction to supplement and extend knowledge of their trades, comparable with that given in technical classes for men. (For information respecting Girls' Trade Schools see Chapter VII, T.E.)

XXII

CONCLUDING REMARKS

For an industrial Nation in an age of mass production a system of technical education wisely directed is absolutely necessary for its welfare, and a broad highway from the schools, the technical institutes and the workshop or factory to the positions of underforemen, foremen, works managers and even for administration, is at least as important as a broad highway from the primary school to the University.

In the concluding Chapter, X, T.E., of the Author's book on Technical Education attention was drawn to the need for and value of technical education to industry. In the accounts of what has been done in education for a number of trades and industries during the past forty to fifty years an endeavour has been made to show how the movements have originated and developed.

Technical education has ceased to be the Cinderella of education. A belief in its value is growing stronger every day and the truth of the opening paragraph will not be questioned by those who have considered the subject or have read carefully the accounts which have been given of the educational movements for a number of industries.

Mass production and the extensive use of machinery have taken away much of the interest which the older craftsmen formerly had in their work and have created an army of skilled labourers which, in the Author's opinion, is one of the causes of labour unrest. A system of technical education wisely directed will do much to restore the loss of interest, remedy some of the evils caused by mass production, improve the social status of the industries and raise the dignity of labour. These were the objects which the early workers in technical education had in view.

In confirmation of this the following extract is given from an address in 1892 on "The Need and Value of Technical Education," by C. T. Millis (published in *Workers on Their Industries*, edited by F. W. Galton):

> "But I am well aware that machinery and the subdivision of labour consequent upon its introduction are often advanced as arguments against the need for technical education. It is said that men need learn only one branch of a trade now, and, indeed, that it is an advantage so to do, since they gain great expertness at that branch, and their labour is thus more productive, and they are better able to earn a living at it. It is further urged that at most only a few need have the wide knowledge of the several branches or processes of a trade necessary for taking part in the direction of the industry. There is no doubt some truth in this, if we close our eyes to the future of our industries, and have no higher aim for our workmen than to turn them into machines dependent upon one minute subdivision of a trade only, and with no prospect of improving their position. But to me it is the strongest argument in favour of some training which shall help to make men better all-round workmen, by giving them at least some knowledge of the processes preceding and following the particular branch of the trade in which they are themselves engaged. By this means they may be enabled more readily to turn from one process to another if the changes in trade or fashion should render such a step necessary, and thus they will be more independent and self-reliant and better fitted to take their part in the struggle for existence."

In some industries, as predicted by the pioneers, the number of skilled craftsmen is becoming insufficient and more attention must be paid to craftsmanship on broad lines. Already a shortage is being felt, especially in industries in which, owing to machinery, there are many operations and subdivision of labour, such as in boot and shoe manufacture, engineering and other industries. The following quotation from Mr. Robert's paper, mentioned under Boot and Shoe Industry on p. 100, supports this view:

> " Hitherto there has been the small and ever-diminishing remnant of the old guard to rely upon for such important technical positions as foremen and works managers, but these old craftsmen are now almost extinct, and reliance for technical guidance rests mainly on the small band of enthusiasts who have been voluntary students at evening technical classes."

In this connection see extract from Wm. Wilkinson's paper on " Training for Textile Industries," p. 139.

In the Board of Education Report on the Engineering Industry, and in papers on the Boot and Shoe Industry referred to in the accounts of these industries, there are indications of the recognition of the importance of a sounder and broader system of training even for the one branch worker. An interesting feature in some trades and industries is the growing belief that a knowledge of handwork is a valuable aid for machine operators.

For example, it is said that for certain departments in boot and shoe manufacture in which machine operations are carried on, these operations are best performed by men who have a knowledge of similar processes as carried out by hand labour.

The Head (W. A. Steward) of the London School of Silversmithing writes to the Author as follows:

> "It should be stressed that there is a strong tendency, in these days of machine production, to ignore the great value of handwork. Machine production is only possible by traditional training in a craft. Handwork lies at the base of all successful machine production, and the importance of the work of the schools directed definitely to individual production cannot be overrated."

In order to keep the skill of our workmen up to its acknowledged standard of excellence, every encouragement must be given, on the production side of industry, to technical or theoretical education as an aid to craftsmanship. Good progress can be made by imparting sound knowledge of principles (not snippets of science) of mensuration, geometry, mechanics, chemistry or other subjects (see Chapters VIII and IX, T.E.) directly applied in a way that will assist practical work and at the same time be of educational value. Much has been done in this direction, especially during the last ten years, but there is still room for further effort.

The Clothworkers' Company and the Drapers' Company are encouraging skilled craftsmanship by making, as one of the conditions of their Exhibitions and Scholarships, that competitors must, in the case of Exhibitions, have worked not in the office but in the industries for at least six months, and, in the case of full-time Scholarships, must have been so engaged for at least eighteen months. For both Exhibitions and Scholarships they must submit a certificate to this effect from their employers and also a statement that they are likely to profit by further study. The Goldsmiths' Company make similar conditions for the Exhibitions and Scholarships which they offer for the Jewellery, Silversmithing and allied trades in London and Birmingham. It may be remarked that similar conditions to the above were made by the Society of Arts in their Technological Examinations from 1873 to 1879.

The Junior Technical Schools in Engineering, Building, Boot and Shoe Manufacture, Cabinet-making, Goldsmiths' and Jewellery, Silversmiths' and kindred trades, are doing an important work in the direction of enabling the future bright intelligent workers to enter the trades at about 16 years, with such a sound foundation knowledge as will enable them, after works and factory experience, combined with attendance at part-time day or evening classes, to become foremen, overseers and works managers, and make them feel they are useful members of society.

It is beginning to be realized that as the number of secondary school pupils increases, they cannot all find openings in the professions and something must be done to encourage them to enter productive industries where they are needed. Otherwise it might be better to have fewer such pupils.

At this stage it is useful to summarize the principal agencies that have helped in the development of technical education from its small beginnings to the present time. The somewhat brief histories given show how much of the success of the early days of the movement in each trade or industry was due to the enthusiasm of a few persons who had a keen interest and belief in technical education, and to the assistance of the City and Guilds of London Institute through its early grants and the development of the Technological Examinations which it took over from the Society of Arts in 1879. These examinations have played an important part in encouraging the opening of a number of technical classes for students engaged in a number of industries.

In addition there was, and has been ever since, the liberal support of the City Companies of London, such as the Clothworkers' Company for the Textile Industries, the Goldsmiths' Company for Engineering Department of the Imperial College of Technology and other Works, the Drapers' Company for its grants to the Finsbury Technical College for several years, and since 1904 its liberal support for Exhibitions and Scholarships for the Textile Industries, the Leathersellers' Company for Leather Tanning, the Cordwainers' Company for Boot and Shoe Manufacture, the Plumbers' Company by its influence on the Plumbing trade through its Registration Scheme, and other City Companies that have been named in the accounts given for several industries.

Since the passing of the Technical Instruction Acts, and particularly during the past few years, the Board of Education has taken an increasing interest in technical education, as shown by its valuable Reports and Inquiries into Education for a number of trades and industries, and the introduction of the National Certificate Schemes for Chemistry, Building, Mechanical and Electrical Engineering.

The Local Education Authorities of such cities as London, Manchester, Birmingham, Huddersfield, Halifax, Bradford, Leeds, have given valuable aid. Professional bodies such as the Institution of Mechanical Engineers, the Institution of Electrical Engineers, and the Trade Associations for Leather Manufacture, Boot and Shoe Manufacture, Plumbing, Printing and Bakery Trades are actively co-operating and considering problems of technical education for their Trades and Industries.

The great increase of literature on technological subjects has been noted.

The total result of the efforts of all these bodies on technical education has been great and much is being accomplished. Changes have come and are coming in the outlook of employers and employees on the recruitment and training of workers for many trades and industries. Several trades and industries are creating an aristocracy of labour by forming what may be termed Trade Professional Associations; for example—The Incorporated British Institute of Certified Carpenters, The National Institution of the Boot and Shoe Industry, The Incorporated Institute of British Decorators, The National Registration of Plumbers, and other similar bodies and schemes (some of which have been mentioned earlier) which have for one of their objects the encouragement of technical education.

In conclusion the Author, in the preparation of this book, has been much impressed by the increasing interest now being taken in the educational training of those engaged on the production side of industry.

APPENDIX I

CITY AND GUILDS OF LONDON INSTITUTE

DETAILS OF EXAMINATIONS IN TEXTILES

SUBJECT	Total No. of Candidates.	Grade I., Grade II. or Final.	No. of Candidates.	Results.			
				1st	2nd	Pass	Fail
25. Woollen and Worsted Yarn Manufacture .	5	I.	5	4	1	—	—
25A. Woollen Yarn Manufacture	75	II.	11	6	4	—	1
		F.	64	22	30	—	12
25B. Worsted Yarn Manufacture	83	F.	83	21	49	—	13
26. Woollen and Worsted Weaving, Division I.	344	I.	21	7	6	—	8
		II.	20	5	11	—	4
		F. Sec. 1	61	26	12	—	23
		F. „ 2	52	14	28	—	10
		F. „ 3	73	38	20	—	15
		F. „ 4	56	23	20	—	13
		F. „ 5	61	25	26	—	10
26. Woollen and Worsted Weaving, Division II.	86	I.	7	4	2	—	1
		II.	2	2	—	—	—
		F. Sec. 1	12	5	5	—	2
		F. „ 2	17	11	3	—	3
		F. „ 3	19	5	5	—	9
		F. „ 4	16	12	2	—	2
		F. „ 5	13	9	4	—	—
27. Cotton Spinning . .	292	I.	2	—	—	—	2
		II.	4	1	2	—	1
		F. Sec. A	155	33	62	—	60
		F. „ B	131	41	55	—	35
28. Cotton Weaving, I. Plain .	24	I.	—	—	—	—	—
		F.	24	10	7	—	7
28. Cotton Weaving, II. Plain and Fancy .	340	I.	—	—	—	—	—
		II.	1	—	—	—	1
		F. Sec. A	194	30	85	—	79
		F. „ B	145	54	44	—	47

SUBJECT.	Total No of Candidates.	Grade I., Grade II., Final, 2nd Year or 4th Year.	No. of Candidates.	Results.			
				1st	2nd	Pass	Fail
27 and 28. Section C.—Engineering as applied to the Cotton Industry	168	F.	168	50	64	—	54
27 and 28. Section D.—The Economics of the Cotton Industry .	224	F.	224	10	128	—	86
28. Section E.—Chemistry as applied to the Cotton Industry .	49	F.	49	9	19	—	21
29. Flax Spinning . . .	20	I.	15	5	5	—	5
		F.	5	1	2	—	2
30. Linen Weaving . .	73	I.	31	15	12	—	4
		II.	18	8	7	—	3
		F. Sec. A	10	3	2	—	5
		F. „ B	14	6	2	—	6
31 and 32. Course A. Silk and Rayon Throwing and Spinning .	1	4th Year	1	—	—	1	—
31 and 32. Courses B, E, F. Silk and Rayon Weaving .	35	2nd Year	11	*2	—	8	1
		4th Year	24	†9	†4	10	1
31 and 32. Course C Silk and Rayon Knitting . .	13	2nd Year	4	—	—	3	1
		4th Year	9	—	—	6	3
31 and 32. Course D. Silk and Rayon Dyeing . .	3	2nd Year	1	—	—	1	—
		4th Year	2	—	—	2	—
31 and 32. Course E. Principles of Art (for Designers)	4	Final	4	—	—	4	—
31 and 32. Courses A, B, C. Mathematics and Mechanics .	7	2nd Year	7	—	—	3	4

* Two candidates passed the 2nd year of Course B, Silk and Rayon Weaving, in the First Class.

† Nine candidates passed the 4th year of Course B, Silk and Rayon Weaving, in the First Class and four passed in the Second Class.

SUBJECT.	Total No. of Candidates.	Grade I., Grade II., Final, 2nd Year or 4th Year.	No. of Candidates	Results.			
				1st	2nd	Pass	Fail
31 and 32. Courses A, B, C. Engineering as applied to the Silk Industry	1	4th Year	1	—	—	1	—
31 and 32. Courses B, C, F. Design and Colour (for Producers) . .	5	2nd Year	4	—	—	3	1
		4th Year	1	—	—	1	—
33. Jute Spinning . . .	121	Inter.	61	26	23	—	12
		F.	60	22	34	—	4
34. Jute Weaving . . .	87	I.	43	25	13	—	5
		II.	29	4	19	—	6
		F. Sec. B	15	—	10	—	5
35. Manufacture of Hosiery, etc.	97	I.	9	2	4	—	3
		F. Whole Exam.	35	13	10	—	12
		F. Sectional to complete.	19	7	8	—	4
		F. Gen'l only.	34	—	—	19	15
36. Principles of Art— *a.* In Pattern Designing	11	F.	11	9	2	—	—
b. Design and Colour (for Producers) .	167	F.	167	79	60	—	28
Totals 1931 .	2,335	—	2,335	713	911	62	649
„ *1930* .	*2,382*	—	*2,382*	*754*	*864*	*93*	*671*

APPENDIX II

THE INSTITUTION OF MECHANICAL ENGINEERS

NATIONAL CERTIFICATES AND DIPLOMAS IN MECHANICAL ENGINEERING

The Institution of Mechanical Engineers, in conjunction with the Board of Education, awards *National Certificates and Diplomas in Mechanical Engineering* to Students who pass with success through approved grouped Courses of Instruction at certain Technical Colleges and Schools in England and Wales and reach a certain standard in the Final Examinations, which are conducted by the College or School Authorities, and are subject to assessment by Assessors appointed by the Institution.

PART-TIME COURSES

(*a*) *The Ordinary National Certificate*
is awarded on the results of *Senior Part-Time Courses*, which usually occupy *three years* and are most frequently held in the evenings. At certain Schools they are, by arrangement with local employers, held in the day-time, or partly in the day-time and partly in the evenings. Students are not admitted to these or other Courses unless they have done suitable preparatory work.

(*b*) *The Higher National Certificate*
is awarded on the results of *Advanced Part-Time Courses*, suitable for Students who have already gained the Ordinary National Certificate or have reached a corre-

sponding standard. They cover normally *at least two years'* work and are generally held in the evenings. Within the limits of the subjects covered by them, they reach the standard of University work.

FULL-TIME COURSES

(*c*) *The Ordinary National Diploma*
is awarded on the results of *Senior Full-Time Courses*, which occupy *two or three years* and demand a suitable preparation such as full-time continuous education up to the age of 16 years.

(*d*) *The Higher National Diploma*
is awarded on the results of *Advanced Full-time Courses*, which occupy *at least three years.* They are suitable for Students who have had full-time continuous education, or who have been for two years in regular employment in Engineering works with concurrent instruction at Senior or Advanced Part-time Courses.

In order to obtain any one of these awards a Student must, among other conditions, make a certain percentage of the possible attendances in each year of an approved Course, and must obtain a certain proportion of marks in each subject in the Final Examination as well as for home work, class work, laboratory work, etc., during the final year of the Course. " Distinctions " are awarded in individual subjects in which Candidates reach a high standard in the Final Examination and are recorded on the Certificates or Diplomas.

A National Certificate or Diploma in Mechanical Engineering is signed by the President of the Institution of Mechanical Engineers, a Principal Assistant Secretary of the Board of Education, and the Principal of the Technical College or School at which the award has been gained. It therefore possesses a Professional and National as well as a Local value.

Holders of *National Certificates* and *Diplomas* in Mechanical Engineering (both Ordinary and Higher grades) who become candidates for election as Students, Graduates, or Associate Members of the Institution of Mechanical Engineers, and are able to satisfy the Council of the Institution of their eligibility under the By-laws for one of these classes in respect of occupation and practical training, will be granted certain exemptions from the Studentship and Associate Membership Examinations of the Institution.

"*National Certificate Prizes of the Institution of Mechanical Engineers*" are awarded by the Council of the Institution to all candidates for the *Higher National Certificate* who reach a certain standard of the grand total of marks in the Final Years of approved Advanced Part-Time Courses.

Similar schemes are in operation in Scotland and Northern Ireland. In the former case National Certificates and Diplomas are awarded by the Institution in conjunction with the Scottish Education Department, and in the latter the Institution awards National Certificates in conjunction with the Ministry of Education, Northern Ireland.

National Certificates and Diplomas in Mechanical Engineering will be further signed by the President of *The Institution of Automobile Engineers* in respect of Automobile Engineering subjects, and Certificates will be signed by the President of *The Institute of British Foundrymen* in respect of Foundry subjects. Provision is also made in certain cases for the endorsement of Certificates with additional subjects on the completion of Supplementary Courses.

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